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[ILLUSTRATED]

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The New Atlantic Cables.

DR. MUIRHEAD'S SYSTEM OF DUPLEXING.

At the present moment, when all the arrangements for working the Bennett-Mackay cables are nearly completed, a self-explanatory plan of Dr. Muirhead's system of duplexing submarine cables will, we feel certain, be most acceptable to our scientific friends.

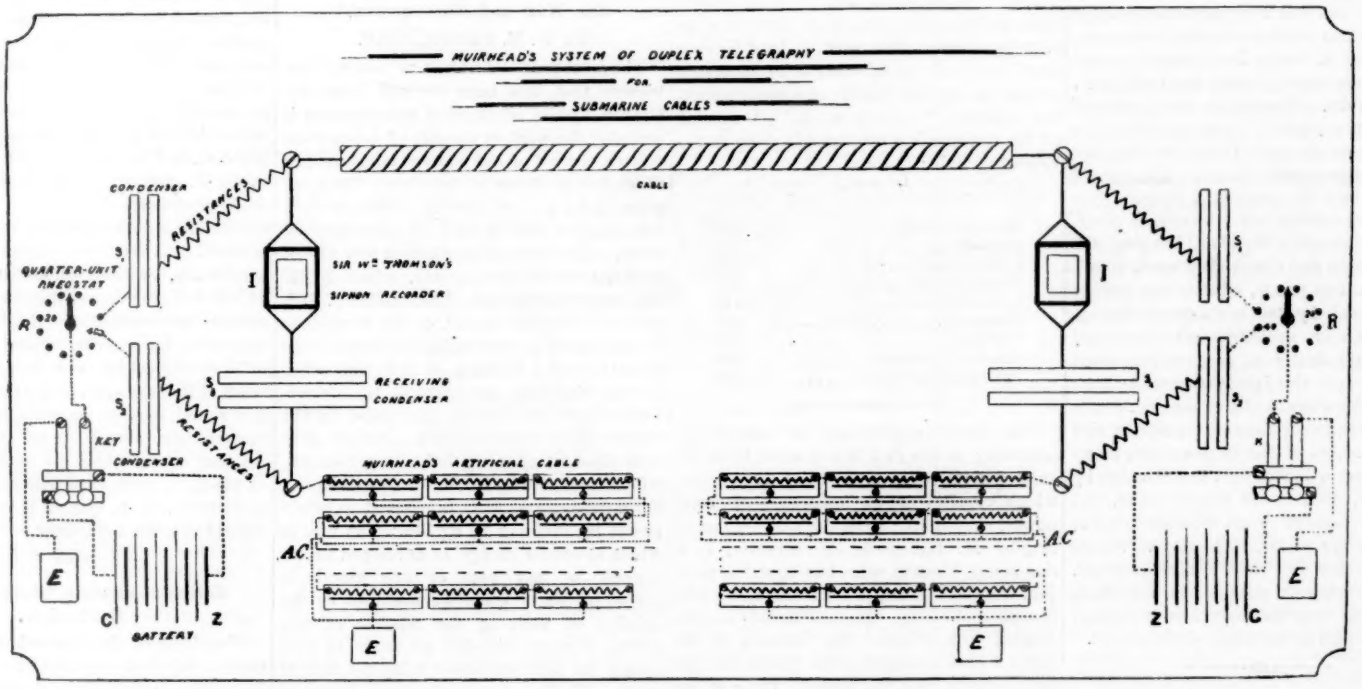
Dr. Muirhead, whose labors in the kindred sciences of chemistry and electricity have made him famous on both sides of the Atlantic, was a student at University College, London, when he discovered the art of making condensers on a principle unknown even to the "great" Varley. The story goes that Mr. John Muirhead was one day complaining to his brother about a number of condensers that had gone wrong, and the young student, who was passionately devoted to chemistry, expressed a desire to see one of the bad condensers. Mr. John Muirhead complied with his brother's request, and the youth, aided by his chemical knowledge, immediately discovered that the paraffin wax had crystallized, and crystallization was fatal to perfect insulation. A remedy flashed across young Muirhead's mind, and he declared that he would make better condensers than either his brother or the illustrious Varley. Mr. John was shocked at the audacity of this stripling of seventeen, and ridiculed the idea. Make better condensers than Varley? *Impossible!* Young Muirhead was not to be crushed even by the man who had first introduced the condenser. He knew he was right. The chemist came to the aid of the electrician, and the result was that Master Muirhead was as good as his word.

Better condensers *were* made, the speed of submarine signaling was increased, and the young student turned his attention to electricity as well as to chemistry—benefiting the public and telegraph companies thereby.

Dr. Muirhead's latest scientific achievement is the building up of an artificial cable for duplex working. Many of our readers are well acquainted with duplex telegraphy as applied to land lines. In the differential principle now in use in this country, it is only necessary to make an artificial line so far as the resistance is concerned. Let us suppose that the resistance of a wire from London to Leicester is 2,000 ohms., then the resistance of the compensation circuit, or artificial line, must also equal 2,000 ohms. But in submarine working, the inductive capacity, as well as the *resistance* of the cable has to be studied. To understand this *inductive capacity*, the student must read attentively the excellent papers on "Ocean Telegraphy," now being published in this journal.

In Dr. Muirhead's system of duplexing submarine cables, the resistance and inductive capacities are combined. "The inductive resistances are composed of a number of plates of tinfoil and paper, similar in construction to ordinary condensers, but with this exception: that whereas in a condenser the sheets of tinfoil are alike in the inductive resistance, each alternate sheet of tinfoil is cut into a girdiron pattern, making a continuous strip of tinfoil; a number of these are placed alternately with plain sheets of tinfoil, interspersed with paraffined paper; the continuous strips are joined alternately together, so as to make one continuous strip—which strip represents the conductor of the cable—and these strips are so regulated in their width that the capacity of the condenser, joined by the strips and plain plates of tinfoil, exactly correspond to the capacity of an equal length of cable represented by the resistance of the strips. The whole of these artificial cables were made by the eminent firm of telegraph engineers, Messrs. Latimer Clark, Muirhead & Company of Westminster, London.

Dr. Muirhead is now in Canso, Nova Scotia, superintending the fixing and adjusting of his apparatus. We wish him a safe voyage home again, and we hope he will receive some recognition of his labors while he is still young and able to enjoy his well-earned laurels.—*The Telegraphist.*



At a meeting of the board of Directors of the St. Paul and Minneapolis Electric Elevated Railway Company last week, George S. Bowen presented the Van Depoele system, which he represents, for their consideration. The idea that Mr. Bowen put forward is to construct, where it is necessary, steel posts twenty feet high, erected in forty feet bents. The trucks of the car are on the top, and the car is suspended from the rails twenty feet in the clear above the street. The trucks are so constructed as to be noiseless, and the rails are deadened so that the wheels will make no noise in running over them. The motor is of the type of the standard dynamos, manufactured by the Van Depoele Electric Light Company of Chicago. The central station can be built at either end of the line, and at this the electric current is generated, and will have the power that the business will demand. The current from the generator is conveyed by means of two copper conductors from the generator to two flat copper strips running the whole length of the track. These copper strips are carried in a base made of iron, thoroughly permeated with insulating gums and glass. The insulation leaves nothing to be desired. Upon these two strips two brushes are traveling with the car, carrying the current to the switches and motor. The whole arrangement is complete in every detail. The cars can be run back and forward with perfect ease, and fast or slow as desired. There will be a double track of the standard gauge, and each train will contain three cars with a seating capacity of sixty people. It is thought the running time between the twin cities, including stops, will be ten minutes. The road equipped will cost about $1,000,000.

Electric Lighting from Primary Batteries.

The "Queen Anne Restaurant," in Cheapside, London, is lighted with 86 Edison-Swan lamps, some of 10 and some of 5 candle-power each, the current being furnished by a primary battery of 150 elements.

Each of these elements is composed of two plates of carbon and three of zinc. The carbons are in a bi-chromate solution in separate porous cells, and the zincs are in dilute sulphuric acid. The whole is contained in a wooden or earthenware jar, the latter being preferred. The lights are in constant operation, day and night. It is found necessary to change the solutions every twelve hours, The Economic Electric Co., which furnished this plant, also supplies batteries to be used for lamps for velocipedes. These are of three elements each, and are hung in a box, which furnishes current for a light of from 2½ to 3 candles for about 5 hours. The electrodes are fastened to the cover, so that when this is taken off the solutions can readily be emptied out at the same time.

Steamship Electric Lighting.

The Hammond Electric Light and Power Supply Company, of London, have fitted one of Mr. James Laing's new vessels with a most complete system of incandescent electric lighting, consisting of a duplicate plant for 150 20-candle-power lights. Each plant consists of a Westinghouse high-speed single-acting engine and a new pattern slow-speed Ferranti dynamo and exciter, coupled together and mounted on one base plate, and running at 600 revolutions per minute. The Westinghouse is one of the most practical forms of high-speed engines. Those used have two cylinders, 9-inch bore and 6-inch stroke, steam acting on one side of the piston

only. All wearing parts are kept constantly in compression, and knocking therefore cannot occur. The generators have been specially designed for ship lighting, the slow speed making it practicable to couple direct to engine, all risks due to intermediate gear being dispensed with, and the space required brought down to a minimum. All parts are to gauge, and to be interchangeable, the wearing parts being arranged so that they can be replaced by any ordinary mechanic, as the electrical parts of the machine have been made permanent and free from wear. Another feature is the extreme lightness of the revolving parts of the machine, which is of first consequence in ship lighting plant, on account of the roll of the vessel at sea. The engines are coupled to the dynamos by means of new flexible couplings, so that none of the vibration on the crank-shaft is communicated to the dynamo. The oiling arrangements have been very carefully worked out, so as to reduce the attendance to a minimum. From one elevated oil vessel all the parts are oiled through a system of pipes, a small valve being placed at each bearing to regulate the supply to each part. After passing the valve, the oil is visible as it enters the bearings. In case of heating, the valve can be fully opened, and the pressure due to the elevation of oil vessel will force oil through and cool down very quickly. The wires have been specially prepared for the company to suit this class of work, and are well protected throughout from all external injury. A great source of trouble has hitherto arisen in ship lighting from the lamps shaking loose in their holders, through the vibration of the vessel. This is obviated by a new type of holder, which is fitted to all the lamps, and is self-locking. This holder is mechanically very strong, and does away with the breakage of the platinum loops so common to the ordinary method of fixing incandescent lamps. The lamps are run in parallel arc, the E.M.F. being 100 volts. The current to all parts of the vessel is controlled by switches fitted to each lamp or group. These switches are efficient, elegant, and simple. The special feature is that the contact surfaces, when making or breaking, never leave each other, but wear smoothly together, keeping the surfaces bright and clean; they break simultaneously at two points, without any jerking action caused by the surfaces separating. All the parts are made by special tools, and are exact duplicates of each other. Each lamp or group is also fitted with a safety fuse, to protect the wires in case of accident to any branch. The two plants are set side by side in a small recess of the engine room, measuring 12 feet 6 inches by 7 feet 6 inches by 6 feet only, open to the engine room, and allowing a passage round the back to get at any part of the plants. The stop valves are placed together and close to a switchboard, so that the engineer, standing in one place, can start and stop the engines or put either plant on to part or the whole of the circuit.

An International Inventors' Exhibition.

An International Inventors' Exhibition will be held in London in 1885, under royal auspices. The exhibition will be divided into two sections, the first being devoted to inventions, processes, and products brought into use since 1862; the second, to musical instruments constructed or in use since 1800. Exhibitors are required to show that their proposed exhibits come within the terms above mentioned. The exhibition is intended to illustrate the industrial progress of a quarter of a century. Only a limited space can be given to each article, and it is desired to illustrate with the apparatus by which a process is carried on a limited number of industrial processes in their consecutive stages. When the invention relates only to parts of a machine, the whole machine will not be admitted unless the improvement cannot be sufficiently well shown without exhibiting the entire apparatus, or unless the exhibit is of surpassing interest.

As the exhibition will be limited to the illustration of industrial processes, examples of either the raw material employed, or the finished product, will only be admitted when they are required for the full demonstration of a particular process. It is not proposed to allot space for the exhibition of manufactured goods alone, unaccompanied by any illustrations of the process of manufacture.

The scope of the exhibition is quite large, about every branch of mechanics being included.

It is believed that many American manufacturers will find it desirable to send exhibits, and in order that they may be provided with proper facilities to avail themselves of the full advantages of the exhibition, our government should certainly make as large an appropriation as was made for the International Fisheries Exhibition. When Congress meets, some member who is anxious to secure the gratitude of the manufacturing interests of the country should move for such an appropriation and the appointment of a commissioner to carry out the plans to assist American exhibitors.—*American Machinist.*

The Heat-Conducting Power of Materials.

Mr. J. J. Coleman, in a paper read before the Philosophical Society of Glasgow, describes some interesting experiments made by him to determine the relative heat conducting power of fibrous and spongy substances, such as cotton, wool, sawdust, etc. The apparatus used resembled in its general features the Lavoisier calorimeter, designed for measuring specific heat, and the method employed by the experimenter entitles the results to no little amount of consideration, and bespeak the accuracy of his conclusions. We note that what he terms "silicate cotton" was the worst heat-conducting, and consequently the best non-conducting material. The description of this substance—to the effect that it "resembles cotton wool in appearance, and is produced in large quantities by blowing steam into melted blast-furnace slag"—proves it to be what is so favorably known in our own country as a non-conducting material, "mineral wood." A resumé of Mr. Coleman's conclusions is given in the following table:

RELATIVE CONDUCTING POWER FOR HEAT.

Silicate cotton	100
Hair felt	117
Cotton wool	122
Sheep's wool	136
Infusorial earth	136
Charcoal	140
Sawdust	163
Gas-works breeze	230
Wood and air space	280

The latest application of electricity, according to the *Pall Mall Gazette*, is an invention made in the interests of lion-tamers, which consists of an apparatus of great power, shaped like a stick, about 3½ feet in length. M. Rauspach, the inventor, is a lion-tamer himself, who has been "a good deal worried" during a long and successful professional career. He has already experimented with it upon the denizens of the cages in his menagerie, and relates the different effects upon the brutes. Three of his lions, receiving the shock, immediately showed signs of the greatest terror. They were seized with trembling, and growled fitfully. The tiger was more quickly subdued, became stupefied, and crouched in a corner of the cage. Bruin was more refractory to electricity, which seemed scarcely to affect him. He would growl and show his teeth, and was subdued after repeated discharges. The most astonishing effects, however, were perceptible in the boa-constrictor. On receiving the discharge, the specimen from Cayenne, nearly twenty feet in length, became at once paralyzed, and remained motionless for six hours afterward. When he recovered he showed signs of numbness for three whole days. Finally the elephant, on being electrified by a touch of the stick upon the tip of his trunk, set up a series of wild cries, and became so strange that the tamer feared the brute would break its heavy iron chain. M. Rauspach is said to intend addressing a paper upon the experiments to the Academy of Science. His discovery in time will be applied to human beings, and a flash of electricity will be prescribed as a certain cure for a bad temper. What would we not give to silence some people for six whole days?

The type for the *Citizen*, of Ilion, N. Y., is now entirely set up by machinery, and an edition of 5,000 printed by the aid of electricity. The type-setting machine was invented by John L. McMillan, of Ilion. His machine avoids all complications in mechanism, and produces a method whereby the letters follow direct and uninterrupted courses in all their movements. Two operators are required, one to manipulate the keyboard and one to space out, while the distributor requires about one-half the time of an attendant to feed the lines to it. The capacity of the machine is 5,000 ems per hour, and no power other than the fingering of the keyboard is required. The distributor is automatic in its distribution of the letters, and has a capacity equal to the setting machine. The face of the type is not touched in its passage through either machine. Type can be distributed at considerably less than half the cost of hand labor.

A fairly powerful magnet is credited to Signor B. Ricco, of Palermo, who surrounds a soft iron core with a long band of sheet iron, having oiled paper between the coils for insulation. One pole is put in connection with the core, to which the internal extremity of the sheet iron band is soldered; and the other pole with the external extremity of the band. The electric current magnetises not only the core, but also each coil of the band, which thus acts both as conductor and as magnetic substance, thereby condensing the lines of force and causing a great concentration of power.

The Watt and Horse-power.*

By W. H. Preece, F.R.S.

The most practical unit in use among electricians that has been derived from the C. G. S. system of absolute measurement is probably the watt, or the rate of doing work when a current of one ampere is maintained through a resistance of one ohm. The work done by an electric current is thus brought into intimate relation with all other kinds of work. The common gravitation unit rate of working is the horse-power, which is 550 foot-pounds per second. The absolute C. G. S. unit is the erg per second, or the work done in one second in overcoming the force of one dyne through a distance of one centimeter. In any electrical measurement the electromotive force (E) in volts, multiplied by the current (C) in amperes, gives a product (E C) equivalent to so many 10^7 ergs per second, which is the watt. There are 746 watts in a horse-power, and E C is reduced to horse-power by dividing it by 746. The rate at which electrical energy is developed or expended in any part of any circuit is given in watts when we multiply by the number of volts by the number of amperes. Strange mistakes are made in confusing the unit of power with the unit of work. No less an authority than Professor Adams, in his inaugural address as president of the Telegraph Engineers and Electricians, spoke of the watt as the unit of work, and gave its value in kilogrammeters as kilogrammeters = watts × 10192. It is evident that, as the watt is the unit of power, it is equal to 10192 kilogrammeters per second, or, in other words, work done at the rate of a kilogrammeter per second = 981 watts = g watts.

I cannot help thinking that the good work of the British Association committee will not be complete until the C. G. S. system is authoritatively applied to work and power. The following table brings together nearly, if not all, the units in common use:

Unit.	*Equivalent.*
Horse-power	33,000 foot-pounds per minute.
"	550 foot-pounds per second.
"	746 × 10^7 ergs per second.
"	7460 megergs per second.
"	759 kilogrammeters per second.
"	1.01385 force de cheval.
"	746 watts.
Force de cheval	75 kilogrammeters per second.
"	542.48 foot-pounds.
"	0.9863 horse-power.
"	736 watts.
Watt	.0013405 horse-power.
"	10^7 ergs.
"	10 megergs.
"	$\frac{1}{9.81}$ kilogrammeters per second.
"	.1029 kilogrammeters per second.
B. of T. unit	1000 watts per hour.
C. G. S. unit	erg per second.
Megerg	10^6 ergs per second.
Watt	10^7 ergs per second.

According to Professor Dewar, a standard sperm candle develops 240,000 foot-pounds per hour, or 4,000 foot-pounds per minute. Now, since a watt is equivalent to 44.2 foot-pounds per minute, it follows that a standard candle develops 90 watts per minute. Again, according to the same authority, 5 cubic feet of coal gas in London develops 2,500,000 foot-pounds per hour, or 4,666 foot-pounds per minute, or 2,976 foot-pounds per candle per minute, which is equivalent to 67 watts per minute. A good glow lamp absorbs 2.5 watts per candle per minute; hence a glow lamp has an economy in energy of about 1-30th of a gas lamp and 1-40th of a standard sperm candle. A man working very hard expends about 100 watts per minute, and if a man-power is equal to, say, one standard candle, it is equal to 1.34 gas candles and 36 electric candles. What a field for economy in lighting, and how essential it is that gas should be applied to the production of power rather than to the production of light.

The horse-power, as a unit, has all the defects of an arbitrary unscientific standard. It involves the use of co-efficients, and it is not connected directly with the absolute system of measurement. It differs in different parts of the world, and its name is misleading. It could be changed both in value and name without any inconvenience, except to those who are too familiar with the existing co-efficients and formulæ. If its value were raised 34 per cent., it would become the kilowatt, and be connected directly with the C. G. S. system. It would thus become a scientific system, and diminish the use of co-efficients. Even the present name could be retained, and its value altered from 746 to 1,000 watts, or from 33,000 foot-pounds to 44,233 foot-pounds per minute without any serious inconvenience. Existing numbers expressing horse-power would simply have to be multiplied by 746 to bring them to the value of the new unit, or numbers in the new unit would have to be multiplied by 1.34 to express their value in the old system.

I cannot help thinking t at the good work of the B. A. committee will not be complete until the C. G. S. system is authoritatively applied to work and power.

Kettell's Electric Clock Setting Mechanism.

The object of this device is to set a great number of clocks synchronously with a far less amount of battery power than is possible by the apparatus in use up to the present time. Clocks in which electricity is the motive agent are subjected to so many disturbances that it seems to be the common opinion that some device for setting the clocks periodically must be substituted. A broken wire or a short circuit, and we have no time. Expense is a great consideration, and few persons can afford to buy new clocks or to pay the price demanded by the companies for delivering to them the standard time.

The above-mentioned disadvantages are avoided by the Kettell mechanism, which is thoroughly effective, can be attached to the nicest parlor clock without in any way spoiling its beauty, for it is placed within the clock, and it can be furnished, moreover, very cheaply. A break in the wire does not interfere in any way with the going of the clock, and a poor clock can be made to indicate exact time by means of this device.

In Fig. 1 the device *B* is shown attached to the clock *A*, which, as shown, can be set from the telephone or telegraph wire, thus

* A paper read before the British Association at Montreal.

necessitating no extra line. This is accomplished by the lever *C*. which is moved by a pin attached to the wheel carrying the hour hand.

Except at the time when the clock is to be set, the lever *C* rests in the position shown in Fig. 1 by the full lines. The course of the current is then, binding screw *a*, lever *C*, spring *d*, to *b*, binding screw *c* to line. In this position telephoning or telegraphing can be carried on through the line. When, however, the clocks are to be set automatically by the pin *e* on the hour wheel, the wheel *C* is raised to the position indicated by the dotted line, and then the current must pass through the electro-magnet *M*. By the central office regulator the line is broken for a few minutes before the time for setting, and the clocks being as shown in the dotted lines Fig. 1, when the regulator again makes the circuit, the current, passing through *M*, releases a train of wheels in *B*, and the cam *f* regulates the clock. This is accomplished as follows: On the arbor of the minute hand are fastened two pins, *i i*, and when the current from the central office regulator, sent through the magnet *M*, releases the train of wheels in *B*, the cam *f* pushes forward the slide bearing the arms *g g*. These pressing against the pins *i i*, bring the minute and hour hands to their proper position. When the arms *g g* impinge the pins *i i*, the pin *x* throws the lever *C* forward, as shown in Fig. 2, and allows it to fall back into its proper position, so that succeeding impulses do not affect the magnet *M*. The spring *s* brings the slide back to its position ready for another setting. Thus all the current required is simply what is necessary to attract the armature *t* of the magnet *M*. Its action is as sure as a Morse instrument. Fig. 2 shows clearly the action of setting the hand, and Fig. 3 the magnet and cam wheels.

In case it is not desirable to use the telegraph or telephone wire for setting the clocks, then the only circuit needed would be through the magnet *M*, and the shunting device *C d*, etc., would disappear. The current would then be sent at the proper time from the central office by the regulator, automatic in its action, release the wheel-work in *B*, and set the hands. The works in *B* are simply the striking works in a clock, and, in case the clock has a striking device, it can be used to do the setting.

On the Variation of the Resistance of Carbon Under Pressure.

[Read before the American Association for the Advancement of Science, by T. C. Mendenhall.]

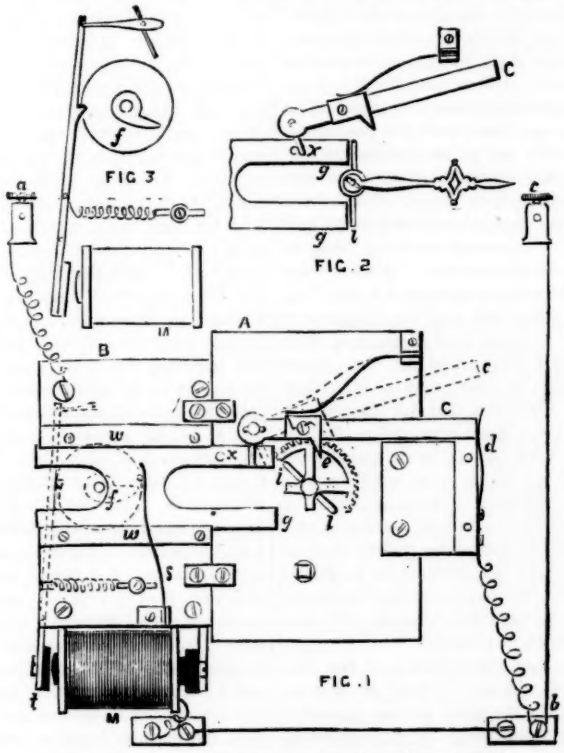
About two years ago, in a brief paper read before the meeting of the National Academy, I called special attention to the influence of time on the change in the resistance of the carbon disc as used in the Edison transmitter. I had occasion at the conclusion to refer to some investigations on the resistance of carbon under pressure that had been made by Professors Tomlinson, Sylvanus Thompson, and Barrett, and to make the remark that the theory which had been suggested by these gentlemen to account for the variation of the resistance was not sufficient to entirely account for the facts. These gentlemen affirmed that it was an alleged effect due solely to the variation of the contact resistance between the electrodes on which the carbon buttons were placed and the electrodes themselves.

A somewhat pronounced notice of this paper appeared in *Nature*, in which the effect was spoken of as an alleged effect, and that there was no evidence of a true change in the carbon, as I had said there was. This was followed by an article by Professor Sylvanus Thompson, in which he quotes Professors Barrett and Tomlinson as agreeing with him that there was no true change of resistance in carbon under pressure.

A short time ago I attacked the problem again. I undertook to settle it, not with reference to the time effect, nor with reference to a quantitative change of the resistance, but solely to determine whether there was a real change in the resistance of carbon under pressure. I began with hard carbon because it is easier to make a crucial test. The method consisted in passing a current through a rod of hard carbon. I used various rods, one of which was an electric light carbon. The copper was removed with the exception of a centimeter in width at each end. Corks were inserted over the ends of the tubes, the inside of these corks being hollowed out clear around and mercury poured in so as to make as perfect a communication as possible. There were unquestionable and invariable results showing a diminution of the resistance of carbon by pressure. It was small but invariable. There was not a single swing of the galvanometer in the opposite direction.

I was aware that this experiment was not a new investigation. Prof. Tomlinson presented in January, 1882. a paper to the Royal Society on the influence of stress and strains on physical forces, in which he proved a change in resistance of carbon under pressure. Prof. Thompson seems to be unaware that the person he quotes as opposed to this view had previously established the fact.

I compressed the rod laterally, so that there could be no possible modification of the contacts by the application of the pressure.



KETTELL'S ELECTRIC CLOCK-SETTING MECHANISM.

I then experimented with soft carbon, although being true for hard carbon it would follow naturally that it was true for soft carbon. I had a couple of tubes with the ends ground obliquely, so that when they were brought together it made a V-shaped tube. The attaching of the carbon button inside one of these tubes was a matter of considerable delicacy, as the buttons are very frail, but I succeeded in getting several attached by means of mucilage. A little mercury was poured in each tube, so that the whole surface of the button was covered. The mercury in each tube was kept at the same height.

I did not determine the absolute resistance, but there were very large changes. For instance, when there was a pressure of 3 mm. of mercury, I had a resistance of 230 divisions of scale (using a high-resistance galvanometer,) and 60 mm. of mercury the resistance fell to 96 divisions.

The experiment is not completely satisfactory, because we are sending our current and measuring our resistance through the same surfaces through which the pressure is transmitted.

I was very anxious to ascertain what had been done by Prof. Barrett, as it was stated that he had tried this same experiment, with mercury electrodes, and had obtained no effect. Prof. Barrett has communicated to me a detailed account of his experiments, and I may be pardoned for sketching them as he has acknowledged they were faulty. A U-shaped tube was used with the button fastened inside, a short distance from the end. Mercury was then poured in the tubes, care being taken to exclude the air so as to get perfect contact. The pressure was brought about by one column only. In this experiment, he was not pressing his carbon button, but only one side of it, the mercury on the other side remaining constant.—*London Electrical Review.*

Electric Synchronism.

In the current number of the Society of Telegraph Engineers' *Journal* is the following abstract of a paper by M. Deprez: "The apparatus proposed by the author consists of two parts, the so-called 'annular comparative instrument,' and a special form of magneto-machine. The latter has a ring of the Paccinotti type arranged between the poles of the magnet, which is free to rotate as well as the ring. Four brushes are used, arranged at right angles, and thus dividing the commutator into four quadrants; two brushes at opposite ends of the same diameter are joined up to the comparative instrument, which consists of a fixed iron ring with two windings of wire, split up in such a way that the successive sections alternately form part of one or the other winding. If two electric currents of different strength are passed through this instrument, four poles will be formed on the circumference of the ring, the lines joining which will be at right angles; but the magnetic forces exerted in their direction will combine to form a resultant, the position of which will depend on the proportion of the two currents, and not on their absolute strength. A magnetic needle suspended at the center of the apparatus will place itself along this polar line. If now this 'annular comparative instrument' be joined up to the Paccinotti ring, and the ring rotated while the magnet remains fixed, the same result will be attained as though the ring rotated inside two distinct magnetic fields. Now each pair of brushes will collect separately the current due to the magnetic influence of the perpendicular component at its line of contact, and the comparative instrument will be traversed by two currents of different strength, which will cause the magnet needle to take up a definite position. Suppose this the initial position, now rotate the magnet, leaving the brushes fixed; then to every angle described by the polar line will correspond a definite value of the ratio of the two components of the magnetic field, and therefore of the two currents produced. It may be concluded that if the brushes and the magnet are rotated at different rates, the comparative instrument, which may be placed anywhere, will show the relative displacement of the two. To adapt such an apparatus for use as a compass, the axis of the rotating ring is placed vertically, and the inducing magnet is done away with, being replaced by the natural magnetic field of the earth. The resultant of the earth's magnetic force at a point can be resolved into two components, the one being a horizontal projection of the resultant, and coinciding with the magnetic meridian—this force replaces the permanent magnet; the second is vertical to the former, and therefore without action on the ring. If, then, the brushes remain fixed, any change, however small, in the magnetic meridian will produce a corresponding change in the comparative instrument. This latter may be placed in any convenient position, while the ring may be placed at the masthead of a ship, out of the way of all influence due to the presence of masses of iron."

Electric Light Installation in the Leipziger-strasse and Potsdamer Platze, Berlin.

Fr. Von Henfner-Alteneck describes in a previous paper in the *Electrotechnische Zeitschrift* the engineering details of this installation. The present deals particularly with the commercial results, which are especially interesting, as the circumstances were such as to allow a fair comparison with gas. The installation consisted of thirty-six arc lamps, and the average length of time each arc was in use during the year was 1,900 hours, giving a total of 68,400 lamp hours. Gas engines were used entirely for motive power, the gas supplied being of the same quality as that used simultaneously for lighting the neighboring streets. The price of the gas was taken as 13.3 pfennige per cubic meter (approximately 3s. 9d. per 1,000 cubic feet), which is the estimated cost of the gas used for street lighting by the municipality of Berlin, and somewhat less than the retail price. The following is an analysis of the cost of maintenance from the 20th September, 1882, to the 20th September, 1883:

	Marks.
Gas consumed (including the lighting of the machine house)	10,156
Water	1,654
Oil and waste	2,096
Carbons for the arc lamps	5,472
Repairs	540
Labor and attendance	3,836
Rent of ground for the machine house.	300
Fire insurance	91
Sundry disbursements	390
	24,535

The author points out that, as each arc light required about 1 horse-power, the cost of the motive power per horse-power hour is about 20 pfennige, or 2.4d. With a steam engine in place of the gas engines, this might be reduced to 0.6d. The actual cost to the municipality of lighting an equal length of the neighboring streets by gas, though not with the same illumination, was 26,000 marks.

The author proceeds to discuss the question of the depreciation of the plant, and makes, in passing, the interesting observation that the cable employed, which consisted of a copper wire served with steeped hemp and sheathed with lead, showed no signs of deterioration, although subjected to an electromotive force of 650 volts.—*Abstract, Inst. Civil Engineers.*

The American Electrical Exhibition will be held in Boston from November 5 to January 3, 1885. The several sections are: The production of electricity, electric conductors, measurement, application of electricity (high power), application of electricity (low power), terrestrial physics, historical apparatus, special novelties, and electrical literature. This exhibition is in the interest of science and education in electrical and mechanical art; also to show rapid advancement made in electricity, its methods and appliances, and its possibilities and probabilities. It is intended to make the exhibition complete and comprehensive in every particular, and to exceed in novelty any that has ever been held in New England.

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We invite correspondence from Electricians, Inventors and the Telegraph and Telephone fraternity on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

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NEW YORK, OCTOBER 25, 1884.

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The first experiment in the use of the electric light for lighthouse purposes, at Hell Gate, proves eminently satisfactory. It is something more than a beacon light, for it illuminates the whole surrounding area, making it so bright that Hell Gate can be navigated as well by night as by day. Brush lights of six thousand candle-power each are used, and, as there are six of them, the aggregate candle-power is thirty-six thousand.

The gas people, in convention at Washington, boast that the electric light scare is over, and that gas prospects never were better. They do not claim that the electric light "must go." On the contrary, they declare that it has come to stay, and that, by staying, it benefits them, because it makes a demand for more light constantly, and that a very large share of this demand comes to them. It is pleasant to know that they have at last learned this lesson, which we and others have been preaching for many months. Let us hope that they will profit by it, and prove their faith by their works. If they really believe what they say, they will cease their senseless opposition to the electric light, rather welcoming it as an ally and friend.

The London *Times*, which is proverbially slow, and never finds a thing out until nearly everybody else has forgotten it, after commenting on the change in trade brought about by railways, has come to the very sage conclusion that "a revolution has followed, much more quickly, through the extension of the electric telegraph to every capital of importance in the world, and to nearly all the minor centers of trade and production." There is nothing particularly new about this, except the fact that the *Times* has found it out. If we are not mistaken, it was the solemn and slow-going *Times* which informed its readers some years since that the telephone, though curious and interesting, had so many limitations that it would never have any practical or commercial value.

TELEPHONE CHARGES.

The letter of our special correspondent in Buffalo, published last week, was purposely given without comment, as we deemed it best to simply give our readers a detailed description of what has come to be known as the "Buffalo system," and let them form their own opinion of its merits on the basis of the facts given.

It is very clear that there has got to be a general revision of charges made for telephone service. While it is clear that many subscribers get their telephones and the attendant service at less than they cost the companies supplying them, it is equally clear that very many subscribers are paying far more than their use of the instrument warrants. In other words, as charges are generally made, there is an element of unfairness and inequality of which subscribers are well aware, and which tends to keep many of them in a state of discontent. A knows that his store is less than a quarter of a mile from the central office, and that his telephone is not, on the average, used more than three or four times daily; and he also knows that B's office is more than a mile from the central office, and that *his* telephone is used more than a dozen times daily. He also knows that both pay the same amount per annum, and, no matter how small the sum may be, no matter if it be insignificant in proportion to the service the telephone renders him, he is bound to believe that an injustice is done *him*, because he is getting less for his money than is B, while the service which B gets costs the company far more than that which he receives.

To see the manifest injustice of the ordinary way of making a "flat" or arbitrary charge, suppose the same system applied to the telegraph business. Is it conceivable that the Western Union or any other company would accept from its customers a lump annual sum, each to pay so much, and then have unlimited use of the company's wires? Even if we suppose the privilege to be restricted to a given and specified territory—say a certain State—does any one for a moment imagine that the scheme would work? Certainly not. The idea would be scouted as preposterous, partly because it would be impossible to fix the proper sum to be paid for an unknown aggregate of business, but chiefly because the system would be unjust and inequitable on its face. And yet this is the system almost universally in vogue in the telephone business.

Now, the telephone is but another form of telegraph, in which every man becomes his own operator. They are distinct, it is true, but there is nothing in the distinction which warrants a departure from the sound business principle that every man should pay for what he gets, and no more; and that every man should get what he pays for, and no less; and it is our firm belief that the telephone business will never stand where it should until this fundamental principle controls it. The "Buffalo system" is one way of accomplishing this—a very satisfactory way, as experience shows, and a very easy and economical way, as will be seen by the description printed last week. Moreover, it has proved—in Buffalo, at least—a very remunerative way, and this is perhaps as important a fact as any in its favor. But we are by no means ready to say that it is the only way. We have never seen anything so good that we were ready to deny the existence of something better, and, excellent and efficient as we believe the "Buffalo system" to be, we are by no means certain that it cannot be improved or surpassed. It is, as a system, simply a means to an end, and, provided that end be reached, it matters not how it is attained, provided always that it be with a minimum of trouble, labor, and expense. But that end, the substitution of a charge based on the service actually rendered for a "flat" charge, based, practically, upon nothing at all, must, in our opinion, be attained somehow, if the telephone business is to be put upon a fair, equitable, and permanent paying basis. If any of our readers have anything to suggest which can contribute to the solution of the problem in any way which to them seems preferable to the Buffalo method, their communications will be welcome.

Telegraphy in Buffalo.

SOME PECULIARITES IN THE MANAGEMENT OF THE WESTERN UNION OFFICE THERE.

(Correspondence of the ELECTRICAL REVIEW).

BUFFALO, N. Y., Oct. 18, 1884.

During my brief stay here I have been permitted to inspect the large office of the Western Union Telegraph Company, and am indebted to the company's manager, Mr. Tillinghast, for much interesting information and many courtesies. The Buffalo office is peculiar from the fact that it is a very important repeating station for through business. Along one whole side of the operating room is a wide shelf about four feet from the floor, upon which are arranged a great number of "quad" repeaters, whose constant "click" tells that they are all at work, and that a number of lines are satisfactorily working on four sides. Each of these repeaters takes the place of eight operators, four receiving and four sending, and does the work with far greater speed and accuracy than any eight operators that could be found.

It is not my purpose to describe this excellently-arranged office, because in the main it does not differ from other Western Union offices of the same size, but there are some distinctive and interesting features to which I wish to allude. I think that one finds here more knowledge and use of delicate test instruments than is ordinarily met with in telegraph offices of its size. For instance, all local "troubles" on lines are tested out for location before the linemen leave the office, and I learn that it is seldom that troubles on any line are not located within five hundred feet, and that the location is never so much as a thousand feet out of the way. This saves time and trouble, and, in the telegraph business, time is the most valuable thing there is.

I was also forcibly struck by the number of young ladies at work in the office in all departments. At the receiving desk are two young ladies, and I learn that since they were put there the number of messages brought to the office by ladies has wonderfully increased, while there has been no diminution in the number brought by the opposite sex. Indeed, when men were at the desk, ladies were seldom seen to come into the office. Now scarcely an hour passes that one or more ladies are not in. This tends to greatly increase the number of social messages, a branch of the business which is, it is believed, destined to grow very rapidly in the future, and add very materially to the company's revenue.

Going up stairs I found that, besides a large number of ladies at the key, there were quite a number flitting about the room, acting as messengers. It is their duty to take messages that come up from below and carry them to the proper operator, and also to carry incoming messages from the receiving operators to the desk, whence they are sent down stairs for delivery by messenger boys. It is part of the duty of these messenger girls to practice at the key for an hour every day, and when they become sufficiently proficient they are put at work as operators, their salaries being raised from time to time according to their skill. Mr. Tillinghast is a believer in employing young ladies as much as possible, and no wonder, for when the strike came, and the great bulk of his operators, among them some of the oldest and best he had, left him, the ladies stood by, and worked faithfully, despite the arguments and even threats of their former associates. Certainly if there ever was work which is specially fitted for a bright, intelligent girl to do, and do well, it is telegraphy. I ought to have said that Mr. Tillinghast makes sure of good material by recruiting his force from the graduating classes of the Buffalo High School, and I ought also to have said that our chief object in making them go through an apprenticeship as messengers from one operating table to the other is to teach them the telegraphic geography of the country.

It will naturally be supposed that, after a year or two, there will be no more need of operators, all the tables being full, and that the chance of promotion for the messenger girls would be very small. At least, this is the way it looked to me, and I naturally asked for information on this point. I got it. In the first place, more or less vacancies will occur from natural causes, one of which is marriage. But the great point is the growth of the business. It is nineteen years since the present manager became connected with the office. Then there were less than a dozen operators, all told. Now there are considerably more than a hundred. That is, the force has doubled itself more than three times in 19 years, and the business shows to-day a more rapid rate of growth than ever before. This means that the force of operators has got to be constantly increased, and thanks to the system that Mr. Tillinghast has adopted, the additions promise to come in the form of bright, intelligent, and well educated young ladies, who will elevate and improve the *morale* of the establishment and increase the efficiency of the service.

I find that all thoughtful telegraph men are giving a good deal of attention to the future of the business; not so much the future of this year or the next, but the great future—the future of twenty years hence. I "tapped" Mr. Tillinghast on this subject by asking him, after he had told me of the past nineteen years, what the state of things was to be nineteen years hence? He told me that the office had but recently moved into the building now occupied; that the company had taken a lease of it for ten years, and that they were fastened there for that time anyway. He added that, although only a portion of the building was now occupied by the company, every inch of room in it was sure to be needed long before the lease expired, and that then something would have to be done with a view to the great future. His idea is that the true thing to do will be to go outside the city, buy a piece of land, and put up a building on it devoted exclusively to through business, so as to keep out of Buffalo all business that does not properly belong to it. He would have an office in the city, as now. In fact, he would have a number of them, so as to bring facilities for telegraphing within the reach of everybody, but he would have no through business and no through wires brought to the city, no wires except those needed to connect the various city offices with the principal office, which should be so far out of town that the city would not grow to and around it for twenty or thirty years at least. This struck me as not only a new idea, but a good one. Come to think of it, there is no good reason why the Western Union Company's office should be where it is on Broadway, It might just as well be above Harlem Bridge, for there is no good reason why half the wires that now run into it should ever cumber the streets of New York at all.

Take it altogether, I have had a very pleasant and instructive visit here, and I venture to say that no telegraph or telephone man can pass two days in this pleasant city, as I have, without learning something new and having a good time. Perhaps there has been a trifle too much Knight Templar, and a thought too much of politics, but you can't have everything to your liking in this world—or the next, perhaps.

Kansas City and Northwestern News.

KANSAS CITY, Mo., Oct. 18th.—There will be quite a number of Western gentlemen visit the Electrical Exhibition in Philadelphia, and endeavor to increase their stock of electrical knowledge. If any one should for a moment suspect that information on this score is chiefly in the cultured East, he is liable to have his eyes opened should he tackle one of our cow-boy electricians. The Westerner may not be able to so trippingly speak of matters synchronous, ohmic, static, voltic, okonitic, etc., but when it comes to making telephones talk, electric lights shine, and buzzers buzz, our money backs the Wasterner every time. There is an inspector in this city who adds to other numerous qualifications that of insensibility to fire. It is doubtful if an electric light current could make him wink, and when he goes out soldering a rag for cleaning, the red-hot soldering iron is dispensed with, the young man using his tongue for that purpose and apparently relishing the taste of the hot metal. Melted lead is to him as chewing gum to the average school girl. His name is C. W. Gaudy, familiarly known among his fellow workmen as the "Professor." Among his recent exploits was that of making a transmitter out of three nails and a cigar box—one that talked, a characteristic that every one will admit a transmitter should possess.

The inventors of a new switchboard for large exchanges reside in this city, and if their board does what is claimed for it, there is a likelihood that even the renowned multiple board will be excelled. Any improvement to be made in central-office facilities for large exchanges will always find a warm welcome from practical telephone men, and prevent the coming of many gray hairs in the heads that are directly interested in operating exchanges of 600 to 2,000. If some genius, or crank, or anybody, would invent an operator with quadruplex ears, mouth and hands, then central office troubles would dwindle away "like specters before the morning sun."

During the month of September, 47 new subscribers were supplied with telephones in this city, making a total of about 800—an increase of 500 in a little over a year. As the demand apparently continues, this exchange will soon take rank near the front with cities of 100,000 inhabitants.

W. J. Long, jr., formerly manager for the Missouri and Kansas Telephone Company, at Leavenworth, has fallen heir to a fortune of about $150,000, left him by his grandfather, a wealthy lumber merchant of Michigan. Mr. Long has retired from telephone circles.

All ground and office and line wire connections are being carefully soldered in this city under General Superintendent Smith's instructions, and a noticeable improvement in the clearness of sound results. As soon as this work is completed here, the cities connected with Kansas City by extra-territorial lines will receive attention, and every possible means taken to make the toll lines operate first class. The lines between here and Topeka and Leavenworth, and Atchison, and Lawrence have more business now than they can carry, but Mr. Smith expects by means of a soldering pot in the hands of an artist, and careful watching of the service, to expedite the business so that the number of calls can be greatly increased. The majority of calls naturally come during business hours, and any means by which rapid handling of them is secured will increase their number and augment the toll receipts.

The following conversation between a Topeka lady and gentleman was inadvertently overheard a few days ago:

Masculine voice—"Hello! Who is this?"

Feminine voice—"Whom do you want? I am 74."

Masculine voice—"I want 18. You're too old."

Two new cables, 100 wires each, have just been strung in this city; one of them nearly ¼ of a mile in length. They work as successfully as those of 50 wires, and are probably the cable of the future as far as aerial conductors are concerned, as they require no more time and expense in hanging than a 25-wire cable would. Another 200-drop switchboard, the improved Western Electric Multiple-board, has been shipped to this point, and will at once be set up, giving the exchange the capacity of 1,000 lines. A healthy growth is reported in all the neighboring cities, and it is likely that the telephone demand in this territory will continue during the greater portion of the coming season. In the territory of the United Company an increase in the number of subscribers and earnings, is reported for the past month, and the probabilities are that the stockholders will find the value of their shares increasing from now on.

In the territory of the Nevada and Kansas Telephone Company, under the immediate supervision of Chas. W. McDaniels, a toll line six miles in length, has recently been completed, extending from Higginsville to Corder. In addition to this toll line, Higginsville is the center of lines from Aullville and Mayview, representing a toll line length of fourteen miles. As Higginsville is a thriving, active town these lines are paying well. A line 20 miles in length, connecting Galena, Columbus and Baxter Springs, all in Cherokee county, Kansas, has been contracted for and will at once be built by Mr. McDaniels. He has just completed a line from Joplin to Lehigh and Carl Junction, a distance of 10 miles, for which there is every assurance that the business will be satisfactory. The Western towns are now fairly beginning to realize the advantages of these connecting lines, and with the continued effort of the telephone superintendents many additional ones will be strung in the near future. Southern Kansas, where everybody seems prosperous and where the towns are all growing, is an especially inviting field for this class of telephone work, and besides, the difficulties to be overcome in building the lines—the ground being level and easy to dig—are very slight. County seats of the majority of Kansas towns, are being connected with neighboring points, and during court sessions the toll lines generally have all the business they can handle.

Kansas City is so hilly and rough that blasting is constantly going on. A line of poles is rarely constructed here but what giant powder is made use of, and the city constantly has men at work blasting for grades and sewers. Some time ago a rock about the size of a freight car was hurled from the side of a hill on Grand avenue, and striking a 55 foot telephone pole, knocked it into kindling wood in a twinkling. Subscribers in that neighborhood quite candidly informed the telephone manager that their lines were crossed with about all others west of the Mississippi river—and it did appear that way until they were untangled. BI-POLAR.

Cardew's System of Dynamo Winding.

This invention consists in an arrangement to enable the same dynamo to be used for working arc, incandescent, or search lights at pleasure. By means of a switch-board placed on the machine, it is possible to so connect up the coils of the magnet fields as to allow of four powerful arc lights being worked simultaneously; or, if four be not required, three, two, or one may be worked in parallel. The arrangement also permits of any of the arc lamps being worked independently of the others. Moreover, by a simple alteration on the switch-board, the machine can be used for working a single powerful hand-regulated search light of 25,000 candles, suitable for naval or military purposes. The same machine will maintain 100 twenty candle-power, sixty-volt Victoria lamps, and, being self regulating, these may be turned on and off at will in any required number, the speed remaining practically constant. It is also possible to work arc and incandescent lamps in parallel simultaneously. The system is peculiarly applicable to differentially wound lamps; and it is stated that no artificial resistance is required in the circuit of the arc lamps to ensure perfectly steady burning and complete independence of action in the lamps. The machine is the invention of Captain Cardew, R. E., and is supplied by Messrs. Clark, Muirhead, & Co., who are prepared to grant licenses for its use.

Electric Light on Steamers.

The Great Eastern Company's last new steamer but one, the Norwich, was fitted with sixty-two Swan incandescent lamps, in opal globes, by Siemens Brothers' northern agent, just sixteen months ago, and they have been maintained ever since by a Gramme 60-light dynamo, driven with rope gear by a Shanks' horizontal engine, without a single hitch due to the electrical portion. There are twelve lamps in the saloon and one in each cabin, besides staircases, etc. When the steamer is running, the special engine takes its steam from the main boilers, but while in port, from the steam-winch boilers, the change being now made without extinguishing the light. The lamps, which cost 4s. 6d., are warranted for 1,000 hours, but many of them last three times as long. There is no electrician on board, but the engineer looks after the dynamo, and the chief steward superintends the lamps and connections. He testifies to the great cleanliness and convenience as well as saving effected by the electric light, breakage of glasses being no small item with the petroleum lamps formerly used.

The Ipswich is similarly fitted, but the switches for turning each lamp on or off are placed outside the cabin door instead of inside, a more convenient arrangement. We may add that all the arrangements on board for passengers' comfort are quite on a par with this great progress of adopting the electric light.

Great preparations for the electric exposition at Boston, which is to take place in the Charitable Mechanic Association building are being pushed forward with vigor under the management of Mr. P. H. Alexander. Nearly the whole of the late exposition at Philadelphia will be transferred to Boston and exhibited in the two large halls. There is to be no charge for floor space, but an entrance fee of ten dollars will be charged. It is expected that the various large educational institutions about Boston will assist in the display. Medals are to be awarded for articles of special value and for the best general exhibit.

In Franklin Hall, illustrated lectures will be given upon electrical science, by experts and scientists. A special feature will be an electrical railway, with a track about 400 feet long. It is the hope of the exhibitors that this system may be adopted for the elevated road which it is proposed to build in Boston. A remarkable feature about this system is, that it lights its own cars and the streets through which it travels.

A specially interesting exhibit will be made of the progress in lighting from the farthing rushlight to the electric lamp. In connection with this exhibit it may not be out of place to add that there are many more candles made and consumed now than in the age of kerosene, or the times which preceded it. A practical system of underground wires for lighting will recommend itself to the immediate attention of the City Fathers. The United States Government is also expected to figure in the catalogue.

Telegraphy is to receive more attention than was given it at Philadelphia, and burglar and fire alarms will clang signals day and night. A new system of police signaling for rural towns by which the police headquarters is to be instantly informed of disturbance, and constantly informed of the actions of the roundsmen, will be an interesting feature. There is to be a complete exhibit of telephones of every size and make. Various motors for propulsion of machinery will be most interesting to manufacturers, who will thereby be enabled to save shafting, belts and pulleys, not to mention annoying accidents and heavy insurance.

The exhibition association is composed partly of New York and partly of Boston capitalists.

A New "Chapter of Erie."

It is no longer a secret that there is trouble in the camp of the Erie Telephone and Telegraph Company. Various bits of information and misinformation—the latter preponderating—have found their way into the public prints, the market price of the stock has been very seriously affected and there is no end of trouble. For a long time—and, indeed, up to the early part of July last past—the management of the company's affairs was confided to an executive committee of three directors, Messrs. Ingham, Downs, and Glidden—in a word, the well-known Lowell syndicate. All seemed to be going smoothly, so far as surface indications showed, when, in July, a petition representing a large number of shares was presented, asking for a change in management. Accordingly, the administration was taken out of the hands of the executive committee. Mr. Downs resigned as general manager. Mr. Ingham offered his resignation as president, but it was not accepted. Mr. Glidden resigned from the New England Company in order to devote his entire time to the interests of Erie as its treasurer, and the full board of nine members assumed the management of the company's affairs. Had the board been harmonious, management of such a corporation by a "town meeting" was out of the question; but when it is considered that the board was rent into two factions, neither of which had any confidence in the other, it is needless to say that there has been simply no management at all worthy of the name. In the days when the company was managed by the executive committee—at that time "*three* souls with but a single thought, *three* hearts that beat as one"—there was always a definite plan and a definite policy, and if not always the wisest, it had the advantage of being stable and firm, uninfluenced by quarrels, contentions, and jealousies. But just now all this is changed. Mr. Ingham has again offered his resignation as president, and although the directors are unwilling to accept it, he insists. This course on his part is largely due to the fact that, at a recent meeting, it being apparent that the immediate raising of a large sum of money was necessary, his proposition to advance one-half of the amount himself and unite with the rest of the directors in becoming responsible for the other half was declined. The crisis in the company's affairs has been brought about by the demand of the Bell Company for its rentals, now overdue to a very considerable amount.

The way out of the difficulty would seem to be the holding of a stockholders meeting, even if informal. The sense of the stockholders obtained, it ought to be easy, through resignations and the filling of vacancies, to so re-organize the board as to at least make it harmonious. The next thing needed is a competent general manager, who has the confidence of the board and the ability to do the work assigned him. With competent assistants he ought to be able to put the company on its feet, for it has a splendid business, a large and very valuable territory, licensed, in the main, on very favorable terms.

It is doubtless true that it would have been better if Erie had not been capitalized at so high a figure; but it is also true that its business, when properly developed, can in all reasonable probability pay a good dividend on the capital stock, and it is no time now to cry over the mistakes of the past. *The thing to do is to remedy them.*

The electrical units are derived from the following mechanical units:

The *Centimeter*, the unit of *length*.

The *Gramme*, the unit of *mass*.

The *Second*, the unit of *time*.

The *Centimeter* equals 0.3937 inch, or one thousand millionth part of a quadrant of the earth.

The *Gramme* is equal to 15,432 grains, the mass of a cubic centimeter of water at 40° C.

The *Second* is the time of one swing of a pendulum making 86,464.09 swings per day, or the $\frac{1}{86400}$ part of a mean solar day.

Telephonic News

⁂ A line of twenty-six copper wires for telephonic use has been established between Liverpool and Manchester. No. 16 wire is used, and the service is said to be excellent.

⁂ Buffalo has two telephone wires to Rochester, 90 miles distant. One is of copper, and runs direct. The other is an iron wire, which is connected through several exchanges. They were recently connected up as a metallic circuit, and worked admirably. Very excellent service is got out of the direct copper line alone, with ground return, but the induction on the iron wire renders intelligible conversation next to impossible.

⁂ Our contemporary, London *Electrician*, says in regard to the experiments made under the auspices of the United Telephone Co., in telephoning from the Grosvenor Hotel, near the Victoria Station, Dover. Messages from this town were distinctly heard in London, but the attempt to hear messages sent from London to Dover and back was not successful. The experiments were much interfered with, owing to the wire used being that on which the London, Chatham and Dover Railway Company send their block system service messages between London and Dover, which interrupted the telephonic communications. But why does not the company adopt the Van Rysselberghe system, as now being applied in Belgium, which permits of telegraphic and telephonic messages being sent simultaneously along the same wire? Intelligence has since reached us that on Monday last messages were spoken from Reading to Weymouth, a distance of 141 miles; and on Wednesday, by special arrangement with the Post-Office, a G. P. O. wire from St. Martin's-le-Grand to Liverpool was connected with telephones, when messages were thus sent over 200 miles.

⁂ The use of the telephone is generally on the increase in most parts of Europe, the subscription in France being at the rate of 200 francs per annum, reduced to 170 francs when there are over 300 subscribers. The manufacturing towns Lille, Roubaix, and Turcoing are now in communication, the average number of messages per day between the two latter places being 657; and the system is in force also at St. Quentin and Troyes. Rheims is the best served town in France for its size, and contains 210 subscribers, or 23 out of every 10,000 inhabitants. This is the highest number, comparatively, in the whole country, Paris, Lyons, and Bordeaux having but 14 to every 10,000, Calais and St. Pierre 22, Havre 18. The total number of French telephone subscribers is 5,535, while Germany has only 4,000 in 21 cities and towns. The proportion at Berlin is 9 to the 10,000 inhabitants, Vienna 4, and Brussels 11. Munich has 393 subscribers, Leipsic 285, and Chemnitz 101. A system has just been inaugurated at Mons, in Belgium, so that the inhabitants of the coal district of the Borinage can converse with Brussels, Antwerp, Charleroi, Liege and Verviers.

⁂ The Dominion Telephone Company has been organized at Montreal to manufacture and use the James Wright patents. The capital is $200,000, of which $100,000 has been taken in Montreal and vicinity. The rentals to be charged are $55 the first year, and $25 subsequently, $30 of the first year's charge purchasing the instruments, and the $25 being for maintenance. In small towns and villages the rates will be $45 first year, and $15 subsequently, with the same conditions. A new feature will be the supply of private switches for 5, 10 and 20 wires. There are at present in operation over 100 sets of instruments in the townships, and over 60 miles of line have been erected, and 100 miles are in course of construction. In Sherbrooke, Megantic, Churchville and a number of other towns, the lines are in operation, and the company expects to commence operations in Montreal in the spring. The invention was made in March by Mr. Wright, and since then the instruments have been in use, it is stated, without interference from the Bell company. A charter was issued to the company on the 9th of August. Mr. E. P. Johnson is president, and Mr. James Wright general manager.

Our correspondent says that the outlook for the sale of stock of this company to the uninitiated is good, that sort of racket not having been worked on the Canadians to the extent it has been practiced here by the Overland and Drawbaugh folks. The company will not attempt to place instruments at present.

Quarreling Among Themselves.

As we have before remarked, an unseemly quarrel has broken out between the National Improved Telephone Company—which is, we believe, heir to the rights and claims of the Rogers Secret Telephone Company, deceased—and the Pan Electric Telephone Company. The latest phase of the quarrel appears in the following interesting letter, which we find in the New Orleans *Item*. As both of these companies infringe the patents of the Bell Telephone Company, the quarrel may be said to be as absurd as it is unseemly:

OFFICE NAT. IMPROVED TELEPHONE CO.,
NEW ORLEANS, October 8, 1884.

GEN. GEORGE D. JOHNSON, Agent Pan Electric Company:

Dear Sir: When you were notified by the National Improved Telephone Company that the Pan Electric Company were using and offering for use telephone instruments that infringed the patents owned by our company, you answered, denying the charge, and published three letters maintaining your denial, written by Gen. Joseph E. Johnston, Gen. A. H. Garland and Senator Isham G. Harris, and another by your electrician, J. Harris Rogers.

We have already exposed the attempt of J. Harris Rogers to make it appear that we had charged the Pan Electric Company with infringing our secret telephone system, when no mention had been made by us of those patents, as you were charged specifically with infringing the McTighe receiver patent and fundamental transmitter patents Nos. 252,255 and 252,521, and that he had evaded all mention of these patents purposely.

The duty we owe the public and ourselves requires that we shall expose the extraordinary character of the remaining portions of that remarkable letter, and we therefore quote from it as follows:

"The Pan Electric has no secret telephone, but only a secret exchange system, which controls the National Improved Telephone patents Nos. 251,292 and 252,257.

"The Pan Electric Company also owns a patent which controls the National Improved Telephone Company's patent No. 257,075, but while owning these controlling patents, never uses them, for such is the wealth of patents (!) of the Pan Electric Company in her general system that she has no occasion to use these controlling patents, and only holds them to restrain rival companies.

* * * * * *

"Even the patents excepted above were bought by the Pan Electric Company, not for use, but simply for their great value to the National Secret Telephone Company.

* * * * * *

"And for these very reasons the National Secret Company have been stock jobbing for three years without establishing a single exchange."

* * * * * *

Immediately upon reading this extraordinary statement, we sent to Washington for all the telephone patents owned by the Pan Electric Company; and to make assurance doubly sure, we obtained from, and we are assured by you, that the following list comprises all the telephone patents owned by the Pan Electric Company, and is the great wealth of telephone patents owned by the Pan Electric Company claimed by Rogers:

No. 268,294, exchange system, November 28, 1884.

No. 269,326, repeater, December 19, 1882.

No. 281,560, transmitter, July 17, 1883.

No. 297,166, soft iron core for permanent magnets, April 22, 1884.

No. 297,167, simple microphone, April 22, 1884.

No. 297,168, simple microphone, April 22, 1884.

Now, the following three patents, out of over fifty owned by the National Improved Telephone Company, are the three patents referred to by Rogers as being controlled by the patents owned by the Pan Electric Company:

No. 251,292, issued December 20, 1881.

No. 252,257, issued January 10, 1882.

No. 257,075, issued April 25, 1882.

It will be observed immediately that the last mentioned patents are older than the first, and yet Rogers had the audacity to assert that the youngest patents controlled the oldest, and that statement is endorsed by the Pan Electric Company.

We now come to that portion of his letter wherein he sneers at the National Secret Telephone Company, of New York, (which he originated and remained with a long time), as being a stock jobbing concern and for the purpose of comparing this "sneer" with the published estimate of the "National Secret Company" by the Pan Electric Company, we quote from a pamphlet recently issued by the Pan Electric Company as follows:

"J. Harris Rogers, late Electrician United States Capitol, will be chief electrician of the Pan Electric Company.

"His 'Secret Telephone,' stocked in New York at $5,000,000, and his 'Electro Gas Telephone,' stocked at $1,000,000, have already enriched himself and others, which past successes promise more to the 'Pan Electric Company, embracing so vast a field of invention and discovery.

* * * * * *

"We, therefore, propose to public consideration a powerful corporation to possess, a little in the future, vast laboratories, learned electricians and skilled mechanics standing ready to seize upon and develope whatever may be presented in the light of its influence, capital and genius. Nor would it seem extravagant to say that such a corporation, with its new methods, might convert great coal fields into torrents of electricity; that it might, in time, harness the very waves, clouds, waterfalls and winds to generate this mysterious agent of nature; and that busy marts and thoroughfares, with their bankers, tradesmen and pompous fashions, may soon be seen thousands of miles distant through the 'telemorphe' riding in carriages without horses, cars without steam, all lighted up by electric suns in a new and enchanting civilization! In a word—that the Pan Electric Company will soon take a high place in the markets of the world and enrich all who are wise enough to measure its grand conceptions.

"One tenth interest will be sold only to moneyed men applying for it, at a mere nominal price, to construct machinery, and other interests will be sold at auction on the N. Y. Stock Exchange for what it may bring; but it is confidentially predicted that the stock will ultimately go greatly above par. It may require years to effect this result, for we depend in no way upon stock jobbing operations, but upon a manly and scientific development of real values which stand on their intrinsic merits.

"Parties investing must examine through their own electricians, experts and lawyers, who will judge whether the inventions are valuable or not, so that if they should, by unseen possibilities, be less valuable than we suppose, or if thieves should creep in and get control and cheat us all, no stockholder can plead the baby act. It is a venture for enormous profits on a trifle. The company has so ventured, and would rather keep its stock and take its own chances of profit and loss than to let babies in."

The above is a true extract from a circular issued by the Pan Electric Company, of which Gen. Jos. E. Johnston is president, Senator Isham C. Harris, vice-president, Gen. A. H. Garland attorney.

WILL THE WORLD BELIEVE THEY AUTHORIZED IT?

Will not Barnum's mermaid lash into foam with its tail the multitudinous seas from pure envy?

Is it possible that business men and sensible persons can be induced to give such a company and such a circular one moment's consideration?

We believe that you gentlemen never realized the position you were being placed in, for there is not one single patent enumerated in your list of telephone patents that we would give five dollars for.

NATIONAL IMPROVED
TELEPHONE COMPANY
OF LOUISIANA.

Some interesting experiments were conducted recently by the United Telephone Company, London, to illustrate the practicability of long-distance wires. The communication established was between London and Dover—a clear distance of seventy-eight miles.

The experiments were made at midnight, the earliest hour at which the railway wires were clear. Even then great disadvantages were encountered, since the wire had to pass as many as nine block signal stations between Victoria Station and Dover. The resistance at each block signal station was calculated as equal to the resistance of ten miles of ordinary wire. Virtually, therefore, the distance traversed by sound between Victoria Station and Dover was something like 174 miles. What is called a metallic circuit was established between Victoria and Dover and back, covering virtually a total distance of 365 miles. Nine telephonic instruments were attached to a wire conducted into the Grosvenor Hotel at the Victoria end. The telephonic engineers were able with ease to carry on animated and rapid conversation with their agents at Dover. The visitors had great difficulty in making out messages which sounded rather cloudy when fresh communications were conveyed. It is impossible to say that an ordinary ear could have followed consecutively any message sent on an unfamiliar subject. On the other hand, such phrase as "Have you got that all right?" was distinctly heard. Attempts to convey such sounds as whistling and singing were only partially successful—partly owing to the lamentable deficiency of the vocal powers of the operators at Dover. On the other hand, the recitation of familiar nursery rhymes like "Jack and Jill" and "Humpty Dumpty" were perfectly successful.

The experiments, conducted under the disadvantages described, showed conclusively enough the practicability of sending messages over trunk lines which are not subject to such resistance as was experienced last night at the numerous signal boxes on the London, Chatham and Dover Railway. That company is now laying down and will shortly open a trunk line between London and Brighton, and this experiment will be immediately followed up by establishing trunk lines between London and Manchester and London and Liverpool in connection with the lines now at work between Manchester and Liverpool. In the United States, through telephonic communication is regularly at work over such distances as 250 miles; and under the favorable atmospheric conditions which exist in Australia, communications have been made at a distance of 1,500 miles.

In the humid and variable atmosphere of this country, such phenomenal successes have not been attained, and are not perhaps attainable, but, as is well known, some of the northern towns have been connected by trunk wires by the subsidiary companies. For instance, the Lancashire and Cheshire Company have joined up Liverpool with Manchester, a distance of thirty-five miles; the National Company have connected Edinburgh with Glasgow, a distance of fifty miles; while the Northern District Company have connected Newcastle with Sunderland, a distance of eight miles, and all these lines are in successful commercial operation.

American Telegraph Operators.

In England an operator's salary varies, being governed to a certain extent by location. For instance, an operator worth $75 per month in New York, Chicago, or any western city, would probably not be able to command more than $65 or $70 in Philadelphia or Boston, the cost of living in the former cities being higher proportionately than in the latter. Taking Philadelphia for comparison: the highest salary paid to a Morse operator is £16 per month. In Philadelphia, the cheapest, nicest, and most English city in the States, a single man can board for £1 per week; a suit of clothes, worth wearing, costs £8; but boots, hats, and linen are quite as cheap as in England. I estimate that £78 per annum is sufficient to pay for living, two suits of clothes, two pairs of boots, two hats, and all necessaries, leaving £114 for the reserve fund, which very few trouble about. The cost of living and obtaining necessaries is certainly not so high as most English operators imagine; but those who indulge in recreation and pleasure cannot save much in consequence of the expenses connected with a day's pleasure. In the first place there is the loss of pay; and what goes in "incidental expenses" is alarming. You cannot open your mouth under five cents (2½d.), and every time a thimbleful of whiskey is indulged in fivepence disappears, and, of course, telegraph operators do often take a few whiskies when "on pleasure bent." In all cities, except Philadelphia and Boston, boarding costs £1. 8s. per week, wearing apparel being about the same price everywhere. I believe the average salary throughout the States might be struck at £12 per month.

From this your readers will be able to form some idea of the value of an operator's salary here, although it is a difficult task to make an accurate comparison. It would be still more difficult to compare a married man's salary, but comfortable five-roomed houses in Philadelphia rent for £2. 15s. per month, all taxes paid. In comparing the actual value of pay in this country it must not be forgotten that we have nine hours duty and no vacation. Therefore, assuming that a £16 operator takes a fortnight's vacation, and allowing four weeks longer time on duty (313 hours), we deduct £16, the imaginary reserve fund is reduced to £90.

An English operator on 50s. per week, with an annual vacation, is not quite so well off, but his vacation can be taken at half the expense of an American operator, railway traveling and enjoyment being very abnormal items here.

A suit has been commenced in the United States Circuit Court by James Converse, Edward C. Wilson, Thomas Merrill and George S. Bulleas, of Boston, trustees and stockholders of the American Rapid Telegraph Company, representing 13,077 shares, against Arthur Dimock, James W. Case, Garrett S. Mott and S. D. Houston, of New York, and William J. Snyder, of Orange, N. J., and the Bankers and Merchants' Telegraph Company, praying for a writ of injunction restraining the defendants from disposing of the property of the plaintiffs while the suit is pending. In August, 1883, an agreement was entered into between the American Rapid Telegraph Company and the Bankers and Merchants' Telegraph Company by which the latter, in consideration of $3,000,000 worth of the stock of the former, contracted to construct for them a four-wire line telegraph connecting with Buffalo, Chicago, Pittsburgh, Columbus, Indianapolis and Terre Haute.

It is claimed that the defendants at the time of making the contract were not directors or officers of the American Rapid Telegraph Company, but that the plaintiffs were owners and holders of the capital stock of the company, and the President was the complainant, James W. Converse. Since then the defendants in the present suit have gained a controlling stock interest in the American Rapid Telegraph Co., through the possession of $3,000,000 worth of stock for the performance of a contract, which, it is claimed, has not been completed, and the present action is brought to restrain the defendants from transferring the stock owned by the plaintiffs to the Bankers and Merchants' Telegraph Company.

The Lewis Self-Binding Insulator.

We illustrate herewith the Lewis self-binding, high-resistance insulator, which dispenses entirely with the use of the ordinary binding wire, and can be applied instantly to the line wire without any tools whatever, whether it be on curves, against walls, under bridges, on roofs, or in any of the difficult positions often met with.

Fig. 1 shows the insulator as ordinarily used. As will be seen, the insulator terminates at the top in a conical screw. There is a "clip" which goes three-quarters around the insulator, with turn-up ends, through which the line wire passes. As the insulator is screwed down upon the pin, the clip and line wire, following the conical thread, go down until they reach the position shown in the cut, where both are firmly held, nor can they be detached without unscrewing the insulator from the pin, in which case they come off as easily as they went on. For all ordinary purposes the hold on the line wire, which becomes slightly bent around a portion of the insulator, is ample, but if, in special cases, a stronger grip is needed, it may be secured by the use of an additional tie wire, as shown in Fig. 2.

If desired, the clip may be dispensed with entirely, and an ordinary tie-wire used. In this case the line wire may be disconnected from the insulator by simply turning the latter round, and a new one put in without cutting the tie wire.

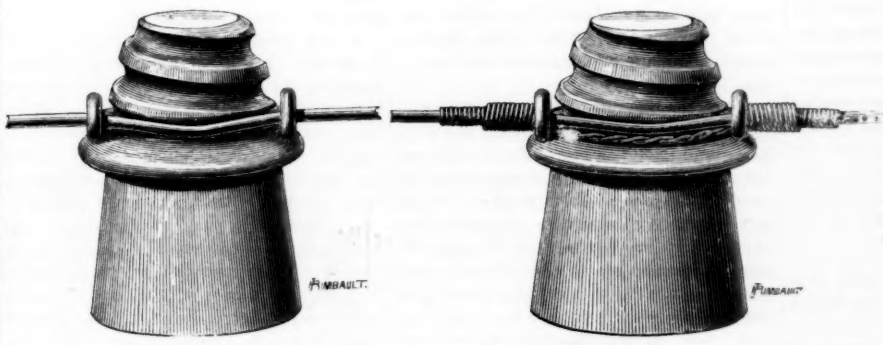


Fig. 1. Fig. 2.

The Lewis Patent Self-Binding, High-Resistance Insulators.

.... The aggregate length of submarine cables in existence, says the *Ironmonger*, is no less than 60,000 geographical miles, or about 111,000 km., or nearly three times as much as the circumference of the earth. Each of these cables consists, on an average, of forty wires, core and jacket together; therefore it may be said that the length of iron and copper wire by which telegraphic communications are carried on at the bottom of the sea is no less than 25,000,000 miles, or ten times the distance of the earth from the moon. At the present day there are seventeen submarine telegraph companies; and there are also four Governments working cables of their own, viz., the British, the French, the Russian, and the Italian Governments. England has laid down in the Indian Ocean 12,018 miles of cable for the protection of her possessions in Asia. France owns about 12,018 miles of cable in the Mediterranean, Russia has some cables in the Black Sea, while those belonging to the Italian Government are few and far between. Of the seventeen submarine telegraph companies there are eight established in London, four in New York, and one in Copenhagen. The following are the most important of them: The Submarine Telegraph Company own nine cables that connect England with the Continent; among these, those of Dover and Calais, Folkestone and Boulogne, Beachy Head and Dieppe and Havre. The Eastern Telegraph Company have a great many cables in the Mediterranean; they have also established direct communication between England and Bombay *via* Lisbon, Malta, Alexandria, and Aden. The aggregate length of this company's lines is 8,041 miles.

The Eastern Extension Company carry their lines from Madras to Batavia *via* Singapore, Saigon, and Hong Kong, and connect Japan with Australia and New Zealand over a length of 6,491 miles. The Anglo-American Telegraph Company own the original Trans-Atlantic cables, viz.: four between Valencia, in Ireland, and Cape Heart's Content, in Newfoundland. Their lengths are as follows: 1. The cable laid in 1869, 1,896 miles; 2. the cable laid in 1866, 1,852 miles; 3. the cable laid in 1873, 1,000 miles; 4. the one laid in 1874, 1,000 miles. They also own the line from Brest to San Pierre, 2,584 miles; aggregate length, 11,282 miles. The Direct United States Cable Company have a transatlantic cable which goes from Ireland to Nova Scotia and Rye Beach, United States, over a length of 3,050 miles. The Great Northern Telegraph Company connect Denmark with Great Britain, France, Russia, Sweden, and Norway, and they are, moreover, in possession of a cable proceeding from Vladivortoch, in Siberia, to Amoy and Hong Kong *via* Nangasaki and Shanghai. Lastly, the Brazilian Submarine Telegraph Company have laid a cable from Lisbon to Brazil *via* Madeira and the Cape Verd Islands.

.... "How much time do you think it would take to send a cable dispatch to Scotland and receive a reply?" was asked of a Kansas man by a Western Union man. Having in mind an experience in the interior of Kansas, when it took a telegram ten hours to reach, by a roundabout circuit, a place only 100 miles distant, a reply was ventured, "About two days."

"Well, that's where you are fooled. Day before yesterday a dispatch was sent from Independence, Mo., to an inland town in Scotland, and a reply was received in just an hour and ten minutes."

"Mulhattan?"

"No, it's no Mulhattan story. It is a fact. It was only an ordinary business dispatch, and it took its turn in the ordinary course of business."

"Do such things often happen to cable dispatches?"

"Well, if there is not a rush of business, and if the wires are in good working order, and the man at the other end replies promptly, it ought not to take more than three hours to get a reply from an English or Scottish town. Two hours and a half is not uncommon time, but one hour and ten minutes is undoubtedly very remarkable time."

"How many transfers are necessary?"

"This dispatch was sent from Independence to Kansas City, from here to St. Louis, thence to New York, thence to the cable office, and thence to England. I suppose there were about five tranfers on the other side. It could not have been a long dispatch, of course, but the time made is still remarkable."

.... It is announced by the International Ocean Telegraph Company that, owing to the breaking of the cable south of Jamaica, telegraphic communication between Cuba and the other Antilles, with the exception of Jamaica, is interrupted. During the interruption messages will be sent by steamers from Santiago de Cuba for Puerto Rico and San Thomas on the 5th, 15th, 17th and 25th of each month, from Jamaica for San Thomas on the 10th of each month, and from Jamaica for Barbadoes on the 24th of each month.

TELEGRAPHIC

.... The shore end of the Bennett-Mackay commercial cable was landed at Manhattan Beach, and New York was wedded to the Old World on Thursday last.

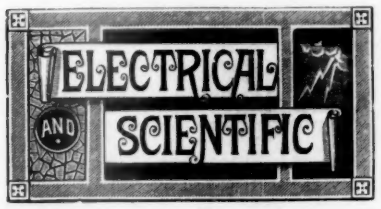
.... A trial was made recently in New York by Dr. Drake, Superintendent of the Stock Exchange, and several members, to test the speed with which a message could be sent to a member of the Philadelphia Exchange and an answer received. The telegraph boy was sent into the Board to Mr. C. B. Gunther, who wrote a message to a customer in the Philadelphia Board. The boy walked 150 feet into the Long Room to the telegraph operator there, who transmitted it to Philadelphia. It was received back, and the answer, "All right," was written and delivered to Mr. Gunther, all in the extraordinary time of twenty-six seconds. This is a fact attested to by Dr. Drake.

.... Notice is given in the *Gazette*, London, that the names of the under-mentioned companies have been struck off the register and the companies dissolved: Anglo-Spanish Telegraph Company, Direct Atlantic Telegraph Company, Economic Telegram Company, Electric and General Engineering Company, Globe Telegraph Company, and the New Atlantic Telegraph Company. Notice is also given that at the expiration of three months from date, unless cause is shown to the contrary, the under-mentioned companies will be struck off the register: Consolidated Atlantic Telegraphs Company, Electric Power Company, and the Universal Telegram Company.

.... The statement of earnings and expenses issued by the Western Union Company for the past three years shows, under all the circumstances, a gratifying growth of business, and that the proportion of earnings distributed among the stockholders was so large as to be an assurance that the new dividends of six per cent. per annum can be paid in the face of strong competition. The statements for the three years ending June 30, 1882, 1883, and 1884 were:

	1881-2	1882-3	1883-4
Revenues	$17,114,166	$19,454,903	$19,632,940
Total expenses	9,996,096	11,794,553	13,022,504
Profits	$7,118,070	$7,660,350	$6,610,436
Disbursements:			
Dividends	$4,798,473	$5,199,124	$5,599,179
Int. on bonds	472,091	436 818	472,350
Sinking funds	40,098	40,094	39,991
Total dis'mts	$5,265,662	$5.555,036	$6,111,530
Bal. profits	1,852,508	1,994,314	498,916

What shows the value of Western Union most is the distribution of gross revenue. In 1881–2, 58.40 per cent. of gross revenue was consumed in operations, 28.04 per cent. went to the stock, 2.51 per cent. to paying interest on bonds, 0 23 per cent. to sinking fund, and 10.82 was credited to surplus. The distribution in the two following years follows: 1882–3, expenses, 64.74 per cent.; dividends, 26 72 per cent.; interest on bonds, 2.14 per cent.; sinking funds, 0.20 per cent.; surplus for the year, 10.20 per cent. In 1883–4, expenses, 66.36; dividends, 28.51 per cent.; interest on bonds, 2.40 per cent.; sinking funds, 0.20 per cent.; and surplus for the year, 2.53 per cent. The important fact brought out by this mode of distributing earnings is that Western Union was able to pay to its stockholders a larger proportion of its earnings than is paid by dividend-paying railroad companies, notwithstanding the amounts from current earnings spent in additions and improvements, competition, and the losses resulting from the strike in the summer of 1883. The reduction of dividends from seven to six per cent. will give the company $800,000 a year so long as the present rates of dividends and earnings are maintained. The increasing quality of Western Union earnings is illustrated by the result of operations for the fiscal year ending June last. In that year competition was sharp, and the cost of the strike in lost business cannot be estimated, yet earnings increased by over $200,000. The increase in operating expenses has been previously explained, and the explanation applies also to the falling off of surplus for the year compared with the two preceding years.



* * As we have already several times announced, the Belgian engineers are actively engaged in arrangements for long-distance telephony by the use of telegraph lines. The price for these communications of this nature will be 1 fr. for five minutes, and 1 fr. 50 for ten minutes of conversation, and the subscribers to a telephone central system will be placed in direct communication with all of the other central systems of the country.

* * A new and important invention has been in operation on the cars of the Kankakee line trains between Chicago and Cincinnati for the last week, consisting of a system of automatic electric train-signals, substituting electricity for the old-time uncertain bellrope, which has been used as means of signaling the engine since railroads came into existence. The new system dispenses entirely with the bell-rope, and places wires in cars with convenient means near at hand for the use of the conductor, enabling him to send his signals from the rear of the longest train sure and quick. When the bell on the engine rings the signals are repeated back to the baggage-car, and may be registered there, thus avoiding disputed signals in case of accident. Another valuable feature of the invention is that when the train is accidentally separated while on the road the alarms are given at once and proper precautions may be taken to prevent damage. The plan has been thoroughly tested during the last few days, and pronounced by expert railway men to be the simplest and best system for signaling yet presented. The Kankakee line will adopt and use the new invention on all its trains as fast as the apparatus can be placed in the cars.

* * Some of the savants are investigating electric insects. General Davis, of the British army, who was a famous insect collector, once picked up a "wheel bug" in the West Indies, and received a shock which paralyzed his arm. On shaking the insect off, he noticed six red marks on his skin—the impression of its feet. This particular bug is now being studied closely. Some of the luminous beetles are found to be very electric, and one investigator, upon taking up an unknown caterpillar in India, received such a shock that his entire left side was paralyzed, and he remained for a long time dangerously ill.

* * During a short conversation with President Hazzard, of the Brooklyn City Railroad Company, he was asked whether any definite plans had been agreed upon to submit to Mayor Low for the running of horse cars across the bridge?

Mr. Hazzard said: "So far as I am concerned, I have some very decided views on the subject."

Being asked to give them for publication, he said: "My idea is that the present system of running cars over the bridge should be abolished. Then let the trustees give all the lines of horse cars passing the bridge permission to cross to Chatham Street, New York. Passengers could thus be carried over the bridge from any part of the city without change of cars."

"How would you operate them?"

"Why, by electricity."

"Would you use horses in the city and electricity on the bridge?"

"No; I believe the time is not far distant when all the surface roads will be run by electricity. I have heard of a system which I believe is a success. All the other methods of operating street cars are, in my opinion, failures, and the cable system is the worst of all. I feel convinced that electricity is to be the motive power of the future."

"And about the fares?"

"That we would have to manage with the trustees. It would only be a matter of detail that could very easily be adjusted."

The American Institute Fair.

The American Institute Industrial Exhibition now in progress at the Institute Building, Third avenue, 63d and 64th streets, New York, proves to be more complete and interesting than was even anticipated.

All the exhibits are now in position, and the general appearance of the exhibition is most brilliant and attractive. The building throughout has been repainted and handsomely decorated, and a new colossal painting representing a mammoth machine shop, added at the easterly end of the main hall, facing the entrance.

This is of itself worth seeing, showing, as it does, what artistic skill can do on canvas, even with such unpromising and unwieldy-looking material as machinery, and much credit is due to Mr. L. W. Seavy, the well-known scenic artist, for his work.

The general opinions, openly expressed, by those who visit the fair, are that it is a better one than usual, and that the novelties presented by inventors are more interesting and of greater value than at any time for many years.

The machinery department is prolifically supplied with new devices which can hardly fail to be interesting to every one. Conspicuous among the exhibits in this department is Thomas J. Stewart's Carpet Cleaner, of 1554 Broadway, in the shape of a huge wheel somewhat resembling the paddle-wheel of a steamboat, with the blades inverted. This machine is in active operation, and appears to do its work thoroughly and well, and without injury to the carpet. A steam road roller, several gas, water, and electrical engines, pumps, well borers, ice-making machines, refrigerators, drills, lathes, slotters, stamps, and many other novelties are also on view.

One of the best, and at the same time useful, inventions shown is the Wing Fan Ventilator, and that it is one of the few patents that does its work, is fully demonstrated by the fact that one of them is placed in the peak of the roof covering the exhibition, where it performs its functions in a most satisfactory manner, removing both the hot and foul air, as well as the dust that previous to its use was a great drawback to a long visit to the fair. It is claimed by the inventors that this fan exhausts 3,600,000 cubic feet per hour, working with a four-horse power, and making six hundred revolutions per minute.

The United States Electric Lighting Company, which does the lighting up of the exhibition, shows incandescent lamps using a new carbon which they claim has solved the problem of securing a perfect carbon for the light; in which regard considerable difficulty has hitherto been experienced. The method of obtaining this carbon is patented by Mr. Weston. The lamps equipped with those carbons have proved to be far superior to those manufactured from any other material. They are said to be more economical, twelve sixteen-candle-power lights being obtained at an expenditure of one-horse power. Their average life far exceeds all others, inasmuch as they will last one thousand hours, and some have been used for three thousand hours. The peculiar zig-zag shape of the carbon gives a light of equal luminosity on every side, which is claimed has been heretofore unattainable by any one.

Another novelty, and what has proved to be really what it purports, is a new disinfectant, called Little's Patent Soluble Phenyle. This preparation has been thoroughly tested and does its work effectively.

Furniture is another great feature of the show, and some of the contrivances on exhibition for economizing space are simply marvelous and must really be seen to be believed; beds that double up into impossible places, chairs that fold in small packages, bath rooms that resemble a handsome cabinet or wardrobe, camp beds that will roll up into almost no size at all, railroad car fixings and such like are here to be found. But it is the miscellaneous class that seems to have the greatest attractions, for therein can be seen almost every conceivable article, while some of them are of such an order as to make it a wonder why they were ever constructed, and for what use they can ever be, until they are explained and examined.

The great attraction of the exhibition, however, seems to be the Arctic outfit lent to the managers by the courtesy of Hon. W. E. Chandler, Secretary of the Navy, the same as was issued to the late Greely relief expedition. The articles comprise a reindeer skin sleeping bag; a reindeer skin suit; a pair of cloth trousers, a pair of laced Alaska socks, a blue jean suit, a pair of woolen socks, a hood, woolen mittens, guernsey jacket, sandals, arctic snow shoes, goggles, eye shields, waist belt and knife, water-proof boots and mittens, overshoes, undershirt, rubber blanket, inner soles, sealskin moccasin boots and a rubber knapsack.

Another novelty which will interest country folks, farmers and delvers after oil is shown by the Pierce Well Excavating Company of L. I. City. So far as can be gathered from the exhibit, which, as far as practicable, is in working order in such limited space, the appliances used are most perfect in character and effective in use. The specialties shown include steel-lined jars, bits, reamers, auger stems, tucker bars, horn sockets, slip sockets, rope shears, millers, pin sockets, rig irons, bull wheels, wood rigs, etc. The engine used to operate these tools is most unique and peculiarly adapted to its work. In fact, even a glance shows its perfectness. By the use of this machine wells for home use and farmers' purposes can be drilled in short order. It is comparatively inexpensive, and from the massiveness of the gear very durable. The company makes a specialty of driving wells for farmers and country housekeepers.

A new process of silk weaving, by John N. Stearns & Co., of New York, is illustrated by the looms they have in operation at the lower end of the main hall, by which they weave brocade and surah silks in a manner which is calculated to supersede the importation of foreign manufacture ers in this line. The work turned out is generally admitted by the trade to be finer and more even than that which is brought from Europe. This enterprise has been founded with the view to stop the sale of imported goods, and from the results already attained cannot fail to be a grand success. The corn husker shown by Post & McGurdey of New York, fills a want long felt by agriculturists, and is the most perfect thing of the kind yet invented. It does its work cleanly and quickly, and is the admiration of all the country people who visit the fair.

A new machine for printing the labels and labelling cans for preserved fruit, vegetables, meat or other goods requiring to be ornamented for market, is shown by Feodor Hirsch, of Albany, and from the easy working ought to prove a success.

The Elastic Motion Sewing Machine is another thing that deserves attention, for it is quite a change from the old form. In mechanical principle it resembles the clock in movement. The machine rests upon its stand on two elastic bearings of sheet steel. Through a loose belt the motion is communicated or continued to the stand wheel, which is fixed in a sliding box bearing upon spiral springs. This box or block of solid steel is confined to a true perpendicular action by two guide bars. Being in all parts balanced in proportion and leverage, and counterbalanced to rest past centers, it only wants the feet of the operator (which supply the clock weights), to put the machine in motion, as the first swing of the pendulum starts the clock. The pendulum of the elastic motion sewing machine is in the rim of the balance-wheel of the stand. The elasticity of the pendulum rod is in this machine contained in the distribution of elasticity. The result is a perfect working, silent, and elastic machine, sensitive to every movement of the operator, and without inequality, perceptible friction or shock.
tion.

Many other novelties are also to be seen, but must wait for more particular men-

The pleasures of a visit to the fair are greatly enhanced by the excellent music rendered every afternoon and evening by Conterno's Ninth Regiment Band.

Points on Lightning Rods.

Mr. A. B. Porter, writing in a recent issue of *Science*, says: "The following passage occurs in J. E. H. Gordon's excellent 'Physical Treatise on Electricity and Magnetism,' vol. 1, p. 24: 'It was held that the knobs [on the ends of lightning rods] must be most efficacious, because the lightning was seen to strike them, and never struck the points. The fact that a point prevents the lightning from ever striking at all was not known.' This is not true. The highest rod on my house is some fifteen feet above the others, and about thirty feet higher than the surrounding buildings; and yet, notwithstanding the fact that it is tipped with a brush of five points, it was struck a few years ago. The points are gilded iron, and the topmost one was melted into a ball about one-eighth of an inch in diameter. The rods are all connected by horizontal pieces held about three inches from the tin roof by glass insulators, after the fashion of ignorant lightning rod agents. The neighbors say that the sparks flew so thickly between the rods and the roof as to resemble a sheet of flame. The shock was, singularly enough, so slight that it is doubtful whether it was due to the electrical discharge, or the deafening crash of thunder that instantly followed the splitting sound of the spark."

The Physiological Bearing of Electricity on Health.*

It is now about two years since I had the pleasure, in conjunction with my colleague, Dr. Kilner, of bringing a paper before this society, in which we tried to lay down some rudimentary basis for physiological measurement of electricity; and I am happy to acknowledge in beginning that the origin of that paper, as it is of this which follows, was due to a former president of this society, Colonel Webber. The former paper was only preliminary, and intended to clear the ground; even in this I cannot for one moment pretend to have reached anything like finality. A few more observations have been made by as accurate measurement as can be obtained, so as to lay, if possible, something like a solid foundation for what has hitherto been entirely built on sand.

In the excellent practical paper† which we had this morning, which was followed by one of the most agreeable discussions I ever heard, a good deal of the ground was cleared which otherwise I should have attempted to cover, and I may therefore take you at once to the physiological relations, and I may say that I shall not speak about lightning accidents. I shall only incidentally speak of it when treating of high-tension currents. The same thing applies to sight. The injuries to sight, no doubt from electric light, although ultimately due to electricity, depend more on the intensity of the light, and the associated motions in space which light carries with it, than on anything which belongs to it as electricity. We have in electric lighting two different things, the two extremes of the spectrum—we have incandescent lights, and we have arc lights. The dangers of the incandescent lights are evidently derived from heat vibrations; the dangers of arc lights are as evidently due to actinic and ultra-violet vibrations.

Perhaps I may be allowed to mention a convenient appliance (for this society always has been, and I hope will long continue to be, a practical society), in which, with the assistance of Mr. Gardner, of Messrs. Baker's, of High Holborn, I have somewhat modified the usual goggles.

The goggles sometimes have to be used for incandescent lights, and sometimes for arc lights. They have blue fronts to them, which keep out the heat rays very fairly; they have also red sides. When I look at an incandescent light, and my eyes get irritable, and the conjunctivæ inclined to be troublesome, I use the blue goggles; when at an arc light, I shut the sides down and use both. I

* Read at the Conference of the Society of Telegraph Engineers and Electricians, Health Exhibition, July 4th, 1884.

† Electric Lighting in Relation to Health, by R. E. Crompton.

strongly recommend these to electrical engineers.

We may now proceed to speak about the subject of my syllabus. It is there said that electricity, as at present used, is at once a source of danger, a possible cause of sickness, and a remedy. What I shall mainly consider will be, in the intermediate space between the danger and the remedy, certain means of measuring the risks of danger, and obtaining something like a basis for definite facts. I was present as a boy, I am proud to say, at Faraday's lectures and experiments. I served as the subject for some few of them; and all that has occurred since—these enormous currents which we are now making use of—were, of course, then practically unknown. But, while electricity has been making bigger strides than any other physical science, electricity as applied to physiology has marvelously hung back, and it is certainly still in the anti-Faradaic period. For this I have given some reasons; one is in the syllabus, that the knowledge of physics and the knowledge of physiology are rarely united, and are to a certain extent incongruous, I might even say antagonistic. The mind of the physiologist is not the mind of the physicist, and there is occasionally a little heating from friction between the two.

There is another reason for it. It is a good thing for the world at large, it is a good thing for science at large, when one very big man comes and occupies a field. He does all the work that can be required. He settles the induction, as Faraday used to say, and then he leaves the rest to the computers. This was done to a great extent for electricity by Faraday himself. But it sometimes happens that a man is too big for his place; and we had in physiology one of those men, Duchenne, of Boulogne, whose work has not been properly appreciated up to now. But his work was not electrical He experimented with a very rough induction coil; and I recollect him well in the Paris hospitals — a little man, energetic like a Frenchman, not grand to look at, but full of work—trotting about examining all the patients with this curious induction coil of his. It was a very bad coil, but it had the gift of exciting muscles: and by testing patiently and carefully for years a number of muscles individually with small pointed conductors by means of his induction coil, which was practically only an irritator, only an electric needle which he stuck into these muscles, he accomplished a great work. He isolated two or three distinct diseases not isolated before, but which are now well known. That work was physiological, not electrical. Now that old-fashioned induction coil is a very complicated, a very uncertain, and a perfectly unmeasured source of force. We do not know—at least we have not known—the least in the world what it is doing. We know that it tickles up the muscles into activity, and we know that if they do not respond naturally it is an indication of some pathological change in the human body. But that is not electrical; it has got the name of electricity without being electricity. As to electricity pure and simple, I am sorry to say I see great evidence that the medical world is somewhat behindhand.

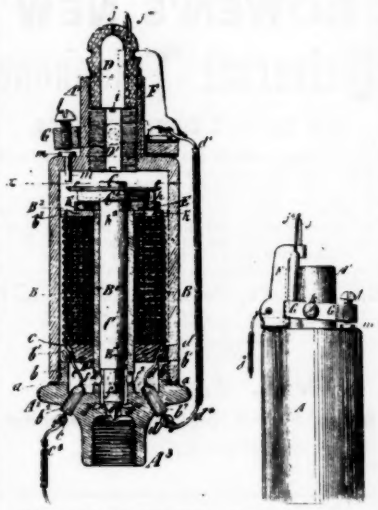
In a medical periodical, the other day, I found a review of a work on electrical medicine. The first statement which it begins with, as a sort of flourish of trumpets, is, "There is no mode of measuring alternating currents." I have not been able to recover that extremely foolish statement, and therefore I will not say where I saw it, but see it I undoubtedly did. Only on the 28th of June an article on galvanic batteries for medical purposes appeared. This is written very much more *bona fide* than the others, and I dare say is, in the main, correct; but I find in this the following statement: "The resistance of the body varies within wide limits—500 to 100,000 ohms." These are wide limits; I think they are wider limits than the Society of Telegraph Engineers would be willing to sanction. If you turn that into current or potential, see what would happen to the patient if during the experiment his resistance should vary from 100,000 ohms down to 500; the man would simply be burnt up alive. Therefore, it is high time we should pay attention to this.

W. H. Stone, M.A., M.B.

The Influence of Electricity on Bread.

The subjoined, from the Pittsburgh *Commercial Gazette*, would indicate that some one in that city is giving a new turn to the declaration in the New Testament, with regard to the bread of life: A communication has been sent to this office which, to say the least, if not quaint, is decidedly original, and if followed up promises to revolutionize the bread industry of this and other countries. In fact, it would seem that there is in store for the people the stern necessity of seeing to it that every man knows his baker, and that the aforesaid man of kneads is a person of good morals, in fact a man after his (the bread eater's) own heart, lest by eating the bread the consumer partakes of the nature of the baker. The communication is as follows:

"I have for some time been studying animal electricity in its various phases, and the result of my investigations leads me to believe that it is possible for human beings to impart electricity to fellow men in ways that would at first thought seem highly improbable. Especially is this possible through the medium of bread-stuffs. In fact, it is impossible to eat bread without partaking of the masculine electricity of the baker who



Young's Polaristic Automatic Gas Burner.

kneaded it, and thus in time the consumer takes on the disposition of the baker. The theory, of course, being, that while shaping the loaves of bread, while yet in the dough, by contact with the same, the baker imparts to it a portion of his nature, which lies dormant in the baking process, but making itself felt in the system of the consumer."

The Polaristic Automatic Gas-Burner.

This ingenious device, which we illustrate herewith, contains, within a very small space, a device for turning on the gas and lighting it, all by the action of an electric current. It will be seen, by examining the half-section cut, that the main line from automatic key comes in at bottom on the left, runs through the core, attracts the circular permanent magnet on top of the electro-magnet, which unlocks it from the loose coil of the electro-magnet, which at once rises to the stationary armature directly under the lava tip. The core being used as a gas valve when raised by the current, opens the valve and allows the gas free passage to the tip through the burner. It is ignited by the spark, which is also produced by the same current which operates the valve. The automatic key being double, by pressing the second button the current is reversed, repels the permanent magnet, drops the core and the valve, and shuts off the gas. In this automatic burner the old-style plug valve is abandoned and the puppet valve substituted, and in such a manner that no lubricant is required. It is perfectly sure to be gas-tight, and work as well in cold and exposed places as in warm. The burner is smaller than others, being only one inch in diameter, and in consequence casts less shadow. Another peculiarity is, that it requires only one wire from key to burner. All in all, it is very simple and complete, and in practical, every-day use is a perfect success. Is is manufactured by A. M. Young, Waterbury, Conn.

Rapid Progress in Electric Science.

The Philadelphia *Ledger* makes the following note of progress in the application of electricity:

"Only twelve years ago Professor Tyndall gave his course of memorable lectures in Horticultural Hall. He had with him as a part of his apparatus an arc light. The lamp was regulated by clockwork, and cost probably ten times as much as the lamps made to-day. It was imperfect in every way, the light being very unsteady, and several times got out of order at critical moments. The current was supplied from a voltaic battery, at a cost that precluded its use for any but lecturing purposes. The battery, besides being costly and troublesome, required the constant work of an attendant for a day or two to 'set up,' and it also was very apt to get out of order. Dynamo machines were not unknown at that time, but they were too costly, and for lecturing purposes the battery was considered best. Looking at the display of lamps in the exhibition, and the great variety and number of dynamo machines, it seems almost incredible that it is only twelve years since such a man as Professor Tyndall was well pleased, rather than otherwise, to be able to exhibit his poorly regulated clockwork lamp, run by some hundreds of cells in a voltaic battery."

At present large cylindrical glass vessels for scientific and commercial purposes are cut, during manufacture, by surrounding them with a thin filament drawn out from the molten glass, and then cooling them suddenly by contact with a cold substance. What is represented as a more sure and perfect method has now been introduced at Fahdt's establishment, Dresden, his plan being to surround the glass with a copper wire, connected by binding screws with the two poles of a galvanic battery, and made red hot by forming contact. After this has been accomplished, the rough edges of the article are then rounded off by revolving the object in a blowpipe flame; and, in order to prevent any unequal or irregular construction of the parts subjected to this action, a slight degree of annealing is effected in the furnace.

Electric Light News

— The New Bedford Electric Light Company has declared a quarterly dividend of 2 per cent.

— The Cunard Company's new liners, the Umbria and Etruria, are provided throughout with the Swan incandescent form of the electric light.

— The enterprising firm of Messrs. Woodhouse & Rawson, electrical engineers, London, have just received the contract for the lighting of the London Stock Exchange, both the new and old buildings, their plant is to be used throughout.

— The Swan Company for Isolated Lighting of New York, about a month ago, started 500 incandescent lamps among the paper mills at Bellows Falls, Ct., with a thoroughly arranged plant. Contracts with other mills have already been made, which will carry the number over 750 lamps.

— The Anglo-American Brush Company has received an order from Finland for the necessary plant to light the theater at the town of Bjorneborg. The plant to be employed will consist of a D 2 Victoria compound-wound machine, 130 Victoria incandescent lamps, and the necessary cable, switches, cut-outs, and fittings.

— An exhibition of Russian and foreign products was opened at Odessa recently. In the evening, the numerous pavilions and *parterres* are illuminated by the electric light.

— Hachette et Cie, the large firm of publishers and booksellers in Paris, with branch in London, have had their folding and binding departments in the Rue Stanislas lighted by incandescent lamps for two years past. So satisfied are they with the results, that they have now arranged to extend the electric light to the whole of their establishment, and have ordered 350 Edison lamps.

— M. Roussy, proprietor of the Gilamont Mills, near Vevay, Switzerland, where the Swan system has been in use over two years, has just invented a regulator which permits the use of the incandescent light at any degree of intensity. The apparatus, which is in the lamp-holder, is very easily operated, being controlled by a button, and is said to be so simple that it makes no appreciable addition to the cost of the lamp holder.

— In referring to the light to be used in the Broadway Tabernacle, in this city, last week we spoke of it as the "Edison" light, when it is in fact the "Weston." This was a slip of the pen for which we tender our apologies to the United States Company.

— The Brush-Swan electric light used at the Hell Gate Lighthouse is the largest in the world. It is estimated that the light is of sufficient power to be seen at a distance of fifty miles. There was no difficulty in discerning the treacherous rocks in the once dangerous Hell Gate, and vessels can pass and repass as readily at night as when the sun is shining. The engine which is used to keep the lights ablaze is of 23-horse power, with a capacity of driving a dynamo battery powerful enough to supply six additional lamps, which are to be used in thick and foggy weather. The light at Hell Gate may be the means of effecting a revolution in travel to Europe, as steamers can now pass through this strait without difficulty and thus save several hours on every trip. In conversation with one of the leading gentlemen connected with the lighting of the "Gate," the reporter learned that there was soon to be an appropriation by the legislature sufficient to blast the remaining rocks in the bed of the river, thereby making it the safest and shortest route to the city for European steamers.

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— A *fete* has been held in Dublin at which a number of Weston arc lamps have been used. This gave so much satisfaction that another *fete* was given at which a still larger number of the lamps were employed. The lights were very brilliant, and were much admired by a numerouns and critical assemblage. The arrangements were under the management of the Maxim-Weston Company, who supplied the whole of the plant.

— The lighting of Hell Gate is pronounced an entire success. The rays of the 54,000 candle-power Brush-Swan electric light were cast far out over New York, Long Island City and the Sound. Vessels forty miles out on the Sound distinguished the steady glow. During the evening a large fire in Harlem reflected its light over the upper portion of the island and afforded an excellent opportunity to test the strength of the light. Viewed from a distance the light appeared a ball of white light, but on nearer approach it was seen to be made up of nine Brush lights, each of 6,000 candle-power. The lamps are placed at an elevation of 250 feet.

— The Electric Light and Illuminating Company of Worcester has been organized under Massachusetts laws, with a paid up capital of $100,000. Mr. Stephen Saulsbury is President, and Mr. Charles B. Whiting, Treasurer. Ten-candle power lights will be used, and it is proposed to start with 3,500 of these, providing, however, for an increase to 4,800. Three 50 horse-power Armington & Sims engines would be used.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING OCTOBER 14, 1884.

306,395 Time indicator for telephone exchanges; C. H. Haskins, Milwaukee, Wis.

306,405 Construction of secondary batteries; William Lachlan, London, county of Middlesex, England, assignor to John M. Pendleton, New York, N.Y.

306,414 Electrical switchboard; Charles W. McDaniel and Albert Barrett, Kansas City, Mo.

306,452 Electro-magnetic car-brake; James E. Withers and George H. Devlin, Henderson, Ky.

306,457 Telegraph and telephone switch; George L. Anders, Boston, assignor to himself and E. B. Welch, Cambridge, Mass.

306,478 Electrical conductor; Perry G. Gardner, jr., North Adams, Mass., assignor of one-half to Giles K. Tinker, same place.

306,495 Conducting cord for telephones; Milo G. Kellogg, Chicago, Ill., assignor to the Western Electric Company, same place.

306,513 Electric conductor; William R. Patterson, Chicago, Ill., assignor to the Western Electric Company, same place.

306,514 Telephonic apparatus; Thomas J. Perrin, New York, N. Y., assignor by mesne assignments to the National Improved Telephone Company, New Orleans, La.

306,517 Electric arc lamp; Edward Pickering, Brooklyn, N. Y., assignor to Maurice J. Hart, New Orleans, La.

306,557 Combined gas and electric-light fixture; S. B. H. Vance, New York, N. Y.

306,558 Combined gas and electric-light fixture; S. B. H. Vance, New York, N. Y.

306,665 Combined telegraphic and telephonic apparatus; Francois Van Rysselberghe, Schaerbeek, Belgium.

306,669 Signal and test circuit for telephone exchanges; Charles H. Wilson, Chicago, Ill.

306,687 Dynamo-electric machine; William Smith Horry, London, England, assignor of one-half to Solomon J. Gordon, New York.

306,697 Lightning arrester; Michael J. O'Sullivan and Thomas J. Houck, Baltimore, Md.

A printed copy of the specification and drawing of any patent to the annexed list, also of any patent issued since 1865, will be furnished by any of the patent solicitors whose advertisements appear in this journal. In ordering please state the number and date of the patent desired.

If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40.00. Various other Foreign patents may also be obtained.

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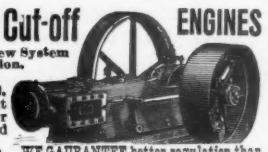
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